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ELECTRONICS AND ELECTRICAL ENGINEERING

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JPRS 75420

2 April 1980

USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 59

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Amplifiers

USSR UDC 621.375

INVESTIGATION OF NEGATIVE-RESISTANCE REFLEX AMPLIFIERS WITH APPRECIABLE GAIN UNDER MAXIMUM POWER-BOOSTING CONDITIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 111-118 manuscript received 5 Dec 77

BUGAYOV, V. YA.

[Abstract] In a previous report, the author and G. N. Rapoport proposed circuits for reflex amplifiers based on diodes with negative resistance in which considerable gain is realized in the mode of maximum power boosting ("Radiotekhnika i elektronika," vol 22, No 10, 1977, p 2129). They also determined the values of gain that could be achieved when the reactive component of diode impedance is independent of the amplitude of the rf current. In this paper the author considers the characteristics of such amplifiers for practicable diode parameters. An analysis is made of the influence that nonlinearity of the reactive component of diode impedance has on the achievable gain. It is shown that the limiting gain of the amplifier in the maximum power boosting mode increases appreciably with an increase in the nonlinear properties of the reactive component of diode impedance. The amplitude response of the amplifier shows hysteresis behavior. The amplifier is not self-exciting, but can readily be converted to a self-excited oscillator. Figures 5; references 8: 5 Russian, 3 Western.
[123-6610]

USSR UDC 621.382

RELIABILITY OF MICROWAVE BALANCED AMPLIFIERS WITH HYBRID CIRCUIT INTEGRATION

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 32-35
manuscript received 10 Jul 79

PETROV, G. V.

[Abstract] Microwave balanced amplifiers with hybrid circuit integration have more nearly linear phase-frequency characteristic and a wider dynamic range as well as lower input and output voltage standing-wave ratios than their discrete version. Here the basic modes of catastrophic failure in such amplifier systems for radio transmitter and receiver equipment are analyzed in terms of their effect on the performance parameters: both input and output voltage standing-wave ratios, gain stability factor, and phase of the transfer ratio at frequencies from 1 to 5 GHz. A balanced

amplifier is considered which consists of two discrete amplifiers with one resistively loaded directional coupler across their inputs and another one across their outputs. The gain stability factor for an amplifier is assumed to be $K > 1$, $0 < K < 1$, $-1 < K < 0$, or $K < -1$ with correspondingly different moduli and phases of the S-parameters, while the Q-factor of the directional couplers on coupled microstriplines is assumed to be ∞. The seven basic modes of catastrophic failure include an open and a short at the input to an amplifier, a short between input and output of an amplifier, an open and a short at the load terminals of the coupler on the input side or the coupler on the output side. An evaluation relative to the performance of a normally operating balance amplifier indicates that it will continue to operate following a catastrophic failure in one of the amplification channels and resistive load circuits, with the gain stability factor decreasing appreciably after failure in an amplification channel but remaining almost the same after failure in one of the resistive load circuits. Figures 3; tables 4; references: 3 Russian.
[126-2415]

USSR UDC 621.382.3:621.391.1

ON A CALCULATION OF PREAMPLIFIER NOISE PARAMETERS

Leningrad IZV. VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79 pp 80-83
manuscript received 16 Nov 78

BONDARENKO, A. V. and BONDARENKO, V. V.

[Abstract] The paper considers a method of analyzing the stability of system parameters during a study of the noise characteristics of a network which makes it possible to reduce considerably the necessary calculation time. The solution is a mean square approximation to a specified change of an output noise parameter (the net current or voltage in the load) with a minimum of the square of the Euclidean standard of error. In addition, an engineering algorithm is proposed for designing amplifying devices according to specified requirements on the stability of the noise parameters. The relationships obtained are illustrated, using as an example the design of a two-stage preamplifier. The paper was recommended by the Department (Kafedra) of the Theoretical Basis of Electrical Engineering, Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin). Figures 2; references 5: 3 Russian, 2 Western.
[120-6415]

USSR UDC 621.385.6

INFLUENCE OF MAGNETIC FIELD ON LEVELS OF HARMONICS IN M-TYPE BEAM AMPLIFIERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 150-156 manuscript received 13 Apr 78

SHEIN, A. G. and SOVA, A. V.

[Abstract] A convenient model for studying phenomena that take place when electron fluxes interact in crossed static fields with complex polyharmonic electromagnetic waves is a planar structure with ribbon-shaped electron beams injected into the interaction space. A general disadvantage of research based on such a model is the assumption of zero potential on the negative electrode and the limitation of an infinitesimally thin electron beam, which makes it impossible to study processes with different external magnetic fields or particulars of the influence that the space charge has on conditions of interaction. The authors propose a model with consideration of the possibility of putting the negative electrode under voltage in such a way that when the external magnetic field varies there need not be any change in position of the injected electron beam, and ensuring satisfaction of conditions of synchronism of the wave and electron flux, and rectilinear electron motion. It is shown that the level of magnetic time harmonics increases with increasing magnetic field for predetermined parameters of the electron beam due to improvement of the bunching process. This means that crossed-beam devices operating in the adiabatic mode have a comparatively high level of signal harmonics. Figures 4; references 10: 9 Russian, 1 Western.
[123-6610]

Antennas

USSR UDC 621.396.67

BETTER DECOUPLING OF ANTENNAS MOUNTED ON A CONVEX OBJECT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 1989-1995 manuscript received 14 Mar 78

LOMUKHIN, YU. L. and CHIMITDORZHIYEV, N. B.

[Abstract] Two or several antennas mounted on a convex object and operating at close frequencies must be decoupled for suppression of interference. In addition to the shielding effect of the convex object itself, when the antennas are optimally spaced on it, further weakening of the microwave shadow field which envelops that object is possible by means of a plane diffracting shield specially installed or already provided by protruding other structures on site. This is demonstrated here theoretically on the basis of field calculations for a convex semicylindrical and a rectangular diffracting shield which resolves the original interference field into mutually compensating components. According to the Kirchhoff approximation and with the aid of Fresnel integrals, the shield location and dimensions are determined which will minimize the shadow field intensity and thus maximize the decoupling between two antennas on such a surface. Experimental data confirm the results and also reveal the band characteristics of such a decoupling device. In a practical application of this method it is necessary to optimize empirically the spacing of antennas and the utilization of intricate objects as diffracting shields. The authors thank B. YE. KINBER and G. A. POSTNOV for the many helpful suggestions. Figures 5; references 13: 10 Russian, 3 Western.
[118-2415]

USSR UDC 621.396.67

ELECTROMAGNETIC FIELD OF AN APERTURE RADIATOR IN THE NEAR ZONE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2007-2013 manuscript received 23 Oct 78

DRABKIN, A. L.

[Abstract] An approximate engineering method is developed for calculating the electromagnetic field of an aperture radiator in the near zone. The aperture of an antenna where the field has the same linear polarization is subdivided into elementary areas, the field due to each area is determined according to the principle of equivalent currents, electric and magnetic, in conformance with the principle of duality, whereupon the

resultant field at any point of observation is calculated by superposition. The calculations are based on the solution of Maxwell equations for a thin Stratton oscillator, each elementary area being treated as a superposition of two orthogonal (an electric and a magnetic) radiators. The resulting expressions are applied, for illustration, to an aperture radiator with the dimensions 0.2 x 0.6 and with a linear field polarization, its E-vector oriented parallel to the long sides of the rectangle. Figures 4; references 2: 1 Russian, 1 Western.
[118-2415]

USSR UDC 621.396.67.01

OPTIMAL POLARIZING SELECTION OF MULTIRAY SIGNALS BY ELLIPTICALLY POLARIZED ANTENNAS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79 pp 2145-2147 manuscript received 20 Feb 78

GOLOVIN, E. S.

[Abstract] Polarizing selection of multiray signals in radio systems is an easy method of reducing multiplicative interference in the form of amplitude and phase fluctuations. On the basis of an analysis of the polarization characteristics by means of the Poincare' sphere, the effectiveness of such selection is evaluated here in terms of the signal-to-noise ratio. A direct coherent wave with circular polarization coming from the transmitter antenna is considered to be the signal, the sum of all components scattered by multiple reflections to be noise. Matching of the receiver antenna to the signal ensures the maximum signal power but not necessarily the maximum signal-to-noise ratio. The latter will be reached at the optimum angular distance between the antenna image and the signal image on the sphere. This angle is found by calculating and equating to zero the derivative of the signal-to-noise ratio with respect to the angular distance. Further analysis of the results indicates that optimum polarization in channels with variable multiray patterns will be most effectively achieved by adaptation of the parameters of the polarization ellipse for the receiver antenna to those variable channel parameters. Figures 2; references: 2 Russian.
[118-2415]

USSR UDC 621.396.671

SYNTHESIS OF LINEAR ANTENNAS BY USING NOMOGRAMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 203-204

ALEKSEYEV, V. S., SALOMATOV, YU. P. and YUROV, YU. YA.

[Abstract] The method of partial radiation patterns is used to synthesize line antennas. The method is given greater flexibility by eliminating the strict relation between the frequencies of the harmonics of the Fourier expansion of the current distribution in the antenna on the one hand, and the linear dimensions of the array on the other. A nomogram for aiding synthesis is presented and the procedure for using it is described. Figures 1; references: 1 Western.
[123-6610]

USSR UDC 621.396.96:621.391.26

DETECTION OF NOISE SIGNALS BY SPACE-DIVERSITY RECEPTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 96-105 manuscript received 7 Feb 78

BERKUTA, V. G., KRASNYY, L. G. and PASECHNYY, S. V.

[Abstract] An examination is made of problems of synthesis and analysis of optimum and quasi-optimum algorithms for detecting noise signals in space-diversity systems consisting of n antennas, and also some spacial cases of optimizing antenna location. The interference immunity of the proposed algorithms is studied, and a comparative analysis is made of the effectiveness of the algorithms with respect to a criterion of maximum area of the detection zone. The authors demonstrate the feasibility of using cumulative decision-making rules to unify the effects from the outputs of individual antennas in a group for signal processing with space diversity. This gives a gain of up to 10 percent in the area of the detection zone as compared with individually operating antennas, regardless of the degree of correlation of signals between antennas. An additional reserve for increased interference immunity in diversity reception is found in signal correlation and optimization of the distance between antennas. This step can increase the area of the detection zone by 30 percent for two antennas, and by 50 percent for three antennas. Figures 6; references: 5 Russian.
[123-6610]

USSR

NOMOGRAMS FOR ADJUSTING ANTENNA-FEEDER SYSTEMS IN THE MEDIUM-WAVE AND LONG-WAVE BANDS

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 27-29

LANDSMAN, M. S., candidate in technical sciences, and STAKHOVSKIY, M. V. engineer, Kiev Radio Center

[Abstract] Nomograms are proposed for simplifying calculations in matching antenna-feeder systems: 1. determination of susceptance, inductance and capacitance of the elements to be matched; 2. determination of the input impedance of the antenna; 3. determination of the reactances of a T-circuit; 4. determination of the reactance X_1 of an L-circuit; 5. determination of the reactance X_2 of an L-circuit. The use of the nomograms is explained, and results are compared with calculations by formulas. Figures 7; tables 1.
[92-6610]

Certain Aspects of Computer Hard and Soft Ware;
Control, Automation, Telemechanics, and Machine Planning

USSR UDC 621.316.925:681.32

MATHEMATICAL MODEL OF DIFFERENTIAL-PHASE PROTECTION OF BUSBARS, AND ITS COMPUTER REALIZATION

Novocherkassk IZV.VUZ:RADIOMEKHANIKA in Russian No 9, Sep 79 pp 800-805 manuscript received 5 Jun 78, after revision 25 Dec 78

SOP'YANIK, VLADIMIR KHARITONOVICH, candidate in technical sciences, senior scientific research worker, Belorussian Affiliate of the Institute of Power Engineering imeni G. M. Krzhizhanovskiy

[Abstract] The author's institute has developed a method of differential-phase protection of busbars based on the principle of double comparison of the half-waves of phase currents as implemented by two phase comparison relays. The phase comparison relay is a NOT logic element with polarized relay at the output. The switches of the NOT gate are normally open MP-26 transistors. Working and interlocking signals with positive polarity obtained from transreactors through OR gates are applied to the bases of transistors T_1 and T_2 through controlled resistors R_1 and R_2 that provide signals of a level sufficient for changing the state of the corresponding switches. The input circuits of the transistors for protection from breakdown by controlling signals are shunted by semiconductor diodes. A resistor balances the potentials on the working and interlocking terminals of the phase comparison relays. A mathematical model of the protector is proposed, based on Kirchhoff's laws for electric and magnetic circuits, and including a description of current circuits consisting of two current transformers, and of the transreactors, OR gate and phase comparison relay. An example is given showing application of the proposed model for computer calculation of current curves with short-circuiting in the protection zone. Figures 3; references: 5 Russian.
[88-6610]

USSR UDC 681.3:656.25-52

USE OF YES-9002 DEVICE IN DATA TRANSMISSION SYSTEM

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80, pp 30-33

KUZNETSOV, A. V., chief of division, Computing Center of Moscow Road; UKOLOV, YU. L., chief of division; and SHMELEV, V. P., senior engineer

[Abstract] In order to eliminate certain difficulties, hardware and software were developed which make it possible, in addition to the existing input-output devices, to connect to the medium speed data transmission

equipment TAP-3A (YeS-8503) used on railroad networks, a device for preparation of data on magnetic tape [UPDML], the YeS-9002, and the printer DZM-180. The hardware and software in question are described in detail. Figures 3.
[124-6415]

USSR UDC 681.32

CONSTRUCTION OF SCHEDULES FOR FULFILMENT OF SUBPROGRAMS ACCORDING TO THE COMPLEX CRITERION "TIME-STORAGE"

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79, pp 50-53 manuscript received 12 Dec 78

MAMATOV, YU. A.

[Abstract] The paper is concerned with a method for construction of a quasi-optimum schedule for fulfillment of information-connected subprograms based on the identical multiprocessor of computers according to the complex criterion "Time-Storage." An example of the proposed method is given. For clarification of the effectiveness of the method, experimental modeling on a computer was conducted, and in the course of the experiments the solution of a number of problems was obtained. The paper was recommended by the Department (Kafedra) of Theoretical Cybernetics, Yaroslavskiy State University. Figures 4; references: 4 Russian.
[120-6415]

USSR UDC 681.142.5

DEVICES FOR INPUT AND OUTPUT OF IMAGES FOR UNIFIED SYSTEM COMPUTERS ON A BASE OF THE "NEVA" PHOTOTELEGRAPH APPARATUS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79 pp 58-61 manuscript received 23 Nov 78

ZAYTSEV, V. M. and CHIGEREV, A. Leningrad Institute of Precision Mechanics and Optics (LITMO); All-Union Aerogeological Scientific-Industrial Association

[Abstract] The principles are presented and a block diagram and the operation are described of a device for input and output of images for Unified System computers [YeS EVM]. The device is realized on the basis of a

complex of "Neva" phototelegraph apparatus and the series device for input of information from punch tape, the YeS-6022. The parameters of the device are:

Resolution	5 line/mm
Maximum dimensions of frame	200 x 300 mm
Number of levels of quantization	256
Range of optical density	0--1.5 D
Number of reproducible gradations	11-12
Maximum time of input (output of image with a dimension of 200 x 300 mm	15 min

The paper was recommended by the Department (Kafedra) of Computing Technics, Leningrad Institute of Precision Mechanics and Optics (LITMO).
[120-6415]

USSR UDC 681.325.3

RING CODING DEVICE FORMING POSITION CODES

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79 pp 53-58 manuscript received 22 Aug 78

CHESNOKOV, YU. N. and SHARIN, YU. S.

[Abstract] A previous work coauthored by Yu. S. Sharin (Izv.Vuz: Priborostroyeniye, 1977, No 2) describes three types of ring coding devices (KKU) which convert the angle of rotation into a binary-decimal code. The method of their synthesis is based on a solution by the method of substitution of n systems of p equations, which describe the operation of such KKU (n = number of digits of output code, p = number of quanta into which the angle of rotation divides). Such a method is cumbersome and requires use of a digital computer. A description of the operation of a KKU by a matrix equation makes it possible to simplify known types of KKU and also leads to the creation of new types of KKU, which form specified position codes. The present work considers a procedure for construction of a matrix equation KKU by a specified design and use of this equation for synthesis of various types of KKU. The paper was recommended by the Department (Kafedra) of Semiconductor and Electrovacuum Machine Building, Ural Polytechnical Institute imeni S. M. Kirov. Figures 2; references: 2 Russian.
[120-6415]

USSR

NATIONAL ENTERPRISE "ROBOTRON"

Moscow RADIO in Russian No 10, 1979, pp 10-12

ZIBER, V., professor, Doctor, General Director, National Enterprise "Robotron"

[Abstract] This article is one of a series celebrating the 30th anniversary of the founding of the GDR. It details some of the work of "Robotron," the enterprise which manufactures the YeS 1055 computer for the CEMA member countries. This general purpose computer is a further development of the YeS 1040, and should be in widespread operation soon. "Robotron" also produces the K 1510 and K 1520 microcomputers, modular machines which can be used as independent computers or included in multi-machine systems. "Robotron" has also set up a training center for YeS computer maintenance specialists in Leipzig. A time-sharing computer center using the YeS 1055 was recently displayed at an exhibition. This article includes photographs of the YeS 1040, YeS 1055, K 1520 and YeS 8404 information teleprocessing system.
[83-6508]

USSR UDC 621.383.8:621.382

FREQUENCY-CONTRAST CHARACTERISTIC OF A VARIBAND CHARGE-COUPLED DEVICE

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80
pp 26-31 manuscript received 10 Apr 79

DENISENKO, V. V. and SHAKHIDZHANOV, S. S.

[Abstract] Variband semiconductors have found wide use in charge-coupled devices for formation of video signals with a controllable spectral characteristic, as in adaptive photoreceivers or in multispectral systems with sequential recording of spectra. Here two types of MOS devices are considered, type A with $\nabla E_g < 0$ and type B with $\nabla E_g > 0$ with light falling on the front side and on the substrate side respectively. Their frequency characteristic, dependence of the output signal amplitude and space phase on the space frequency of a harmonic input signal, is calculated from the two-dimensional second-order differential diffusion-drift equation with appropriate boundary conditions and with the quantum yield of the internal photoelectric effect in the photoelectric function normalized to 1. The trend of this characteristic is interpreted in terms of light absorption within the space-charge region or within the neutral region, in semiconductors with a linearly varying width of the forbidden band. The results are compared with those for semiconductors with a nonlinearly varying width of the forbidden band, such as Si and some $A^{III}B^{V}$ compounds, also with those for a plain charge-coupled device. Variband charge-coupled devices with light falling on the substrate side are found to be preferable, because radiation is absorbed farther from the surface and because minority carriers generated far from the space-charge region move toward it not only by diffusion but also driven by the built-in electric field. In variband devices, moreover, the quantum efficiency is decreased less by surface recombination. The spectral range is wider with a semiconductor where the width of the forbidden band varies nonlinearly, but within this range the performance with a semiconductor where that width varies linearly is better. Figures 3; references 14: 9 Russian, 5 Western.
[126-2415]

USSR UDC 621.397.6-182.3

THE "MAGNOLIYA" AND "MAGNOLIYA-80" PORTABLE COLOR TV STATIONS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 10, Oct 79, pp 53-57

GARAN, P. S., GERSHKOVICH, YA. M., KATS, V. SH., KUDAKOV, A. A., SEROV, L.L.

[Abstract] Some 40 "Magnoliya" and "Magnoliya-80" mobile TV stations will be used to cover the summer olympics in Moscow. Each of these stations includes 4 TV cameras, a mixer with 14 inputs, 3 input and 3 output cables, a TV character generator, remote control electronic clock, a sound mixer with 20 inputs, 2 magnetic sound recorders, a microwave radio link, service communication link, as well as testing, synchronization, control, switching and electric power supply equipment. The "Magnoliya-80" is an improved version of the "Magnoliya", capable of operating with 9 external programs rather than 5, and producing the primary and two secondary output signals in place of the primary and one secondary output signal. Brief descriptions are presented of the video mixer, control, switching and signalling system, TV cameras, synchronization system, testing system, service communication system audio equipment and power supply. Photographs are presented of the mixer panel for the audio section and the TV technical director's console. Figure 5; references: 3 Russian.
[82-6508]

USSR UDC 681.84.083.8

CHARACTERISTICS OF THERMOMAGNETIC ANALOG RECORDING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 10, Oct 79, pp 35-40

PAVLOV, A. YU., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] Thermomagnetic analog recording is a new method of linearized contactless recording of electric signals on moving magnetic tape by heating of the tape to a temperature above the Curie point with subsequent cooling in a magnetic field. The method is attractive because it allows linearization of signals without the use of high-frequency magnetization, contactless recording eliminating the wear of the recording head and the tape, high speed recording by rapid scanning of the laser beam over the surface of the information carrier and extremely narrow recording tracks placed quite close together. Printthrough is found to be 4-12 db stronger than with normal recording techniques, varying with the length of time between recording and overlay winding of the tape on the reel. The signals were found to be stable once recorded at temperatures of up to 383 K (on BASF chromium dioxide tape). Signals were found to be rewritten during erasure by a constant laser beam, meaning that several passes were necessary for complete erasure. Bulk erasure is possible by simply heating reels of tape to slightly over 400 K. The operating mode of the laser has a significant influence on the quality of the recording, the best resolution being achieved with the laser operating in a single mode at a certain optimal power level. Figures 2; tables 3; references 9: 5 Western, 4 Russian.
[82-6508]

USSR UDC 771.537.611:778.4

LONGITUDINAL RESOLUTION OF DETAILS AND INFORMATION DENSITY IN A THREE-DIMENSIONAL IMAGE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian, No 10, Oct 79, pp 26-29

R. BUERGO PRUNEDA, Cuba, S. B. GUREVICH, D. F. CHERNYKH

[Abstract] A criterion is introduced in order to estimate the longitudinal resolution of an optical system, and to determine the volume of an element of information within which details of the object cannot be resolved. An estimate is also presented of the information density in three-dimensional images. The Rayleigh criterion is used to define the minimum distance between two resolved points on the z axis in a system. An equation is presented for a system with only diffraction limitations, another for a system with slight aberrations. The longitudinal resolution is found to be much poorer than the resolution in the image plane, greatly reducing the theoretical information density of three-dimensional images. Figures 4; references 9: 5 Russian, 4 Western.
[82-6508]

USSR

THE "ANTIAIRCRAFT AIR BATTLE TV GAME"

Moscow RADIO in Russian No 10, 1979 pp 44-49

GOROVIKOV, V., Mytishchi, Moscow Oblast

[Abstract] A simple TV game is described, and schematic diagrams and drawings are presented in order to allow construction of the hardware needed to play the game by amateur constructors. As the game is played, a spot on the TV screen representing an aircraft moves across the screen, and the player "fires" an "antiaircraft missile", controlling its movement with a "joy stick" controller in an attempt to intercept the aircraft. In a further development of the game, two players can both fly aircraft, controlling them with their joy sticks, and fire air-to-air missiles at each other. If the two aircraft are guided to the same spot on the screen at the same time, a realistic explosion effect occurs and both aircraft are considered destroyed. Figures 10.
[83-6508]

USSR UDC 543.46

EMPLOYMENT OF THE STROBOSCOPIC METHOD IN LONG BASE LINE RADIO INTERFEROMETRY

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 23, No 10, 1979 pp 1276-1278
manuscript received 1 Feb 79

KUZNETSOV, YU. P., Special Design Bureau, Moscow Power Engineering Institute

[Abstract] The accuracy and resolution of an interferometer are determined by the width of the envelope of the cross-correlation function. In order to increase measurement accuracy in long base line radio interferometers used for the purpose of measuring the delay of a received signal between antennas, it is necessary to increase the width of the signal range utilized. Accuracy in measurement of the delay of a signal on the order of fractions of a meter requires a passband width for the interferometer on the order of hundreds of megahertz. Direct broadening of the signal range is restricted by the limitations of the passband of the interferometer's output units, such as the radio relay unit and the recording and processing units, and their passband presently is in the range of 10 MHz. Expansion of the resulting signal range is now accomplished by the method of synthesizing the signal reception band, i.e., by receiving, recording and processing individual sections of the spectrum of the observed source's emission by sequential tuning of the local oscillator. The cross-correlation functions of sections of the spectrum are added. Another method is described here for achieving a wide signal band with restriction of the passband of output units. By this method strobe pulses are employed to select broadband signals in the output of receivers. The passband of the input units, Δf_{vkh}, is determined by the required width of the cross-correlation function of signals. For a distance between the first zeroes of the cross-correlation function of $2\tau_0$, $\Delta f_{vkh} = 1/2\tau_0$, assuming that the frequency response of the high-frequency channel is square. The repetition rate of strobe pulses, F_s, is determined by the passband of the output units, where $F_s \leq 2\Delta f_{n[low]}$, and the length of these pulses equals $\tau_s \leq \tau = 1/2\Delta f_{vkh}$. This selection of parameters makes it possible for an interferometer to operate with a low-frequency channel band which is much narrower than the band of the high-frequency signal. After correlation processing, a cross-correlation function is obtained which is determined for discrete values of the delay divided into intervals equal to the repetition rate of the strobe pulses, $T_s = 1/F_s$. Additional measurements are made in which the strobe pulses of one channel are delayed by an amount which is a multiple of the maximum duration of strobe pulses, $\tau_z = n\tau$, where n is the number of the measurement. The total number of measurements, N, is determined by the initial indeterminacy of the signal delay time, Δt_n. From two readings of the cross-correlation function a determination is made both of the delay and of the value of the cross-correlation function maximum. An interferometer

employing sampling of signals by this method is called a stroboscopic interferometer by analogy with stroboscopic oscillographs. Block diagrams are given of both of these instruments for comparison. Stroboscopic units with a time resolution of fractions of a nanosecond have already been created, so application of the stroboscopic method should not have limitations from the viewpoint of technical complexity in the creation of broadband units and systems for determining delay. The author thanks V.I. Galkin, G. Yu. Kobzarev and S. F. Leonenko for fruitful discussions. Figures 2; references 6: 4 Russian, 2 Western.
[93-8831]

USSR UDC 621.396.946.2

OPTIMIZATION OF SATELLITE COMMUNICATION LINES FOR RECEPTION OF HIGH SPEED DIGITAL SIGNALS

Moscow ELEKTROSVYAZ'in Russian No 12, 1979, pp 7-9 manuscript received 2 Jul 79

[illegible]EBEL'SKIY, M. D., PAN'KOV, G. KH and TSIRLIN, V. M.

[Abstract] A computer program has been developed to calculate the combination of linear and nonlinear components characterizing the total energy losses of a satellite digital transmission system. The earth station transmission line and the satellite relay (TWT) hardware are described mathematically as a quadrupole with an equivalent transfer function. The return link is described by the same method. Because of the properties of the model, the actual signal can be approximated by a pseudorandom sequence. Actual line tests have confirmed the reliability of the model. Analytic calculation and line testing have shown that by optimizing the parameters of the line section and selecting the optimal signal level at the input of the nonlinear element of the satellite line, the power losses can be reduced to not over 3 dB for the particularly type of equipment used. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 3; references 4: 1 Russian, 3 Western.
[143-6508]

Communications, Communication Equipment, Networks, Data Transmission and Processing

USSR UDC 538.574.6

CALCULATION OF THE ATTENUATION FACTOR ALONG AN EXTENDED ROUTE WITH A SINGLE OBSTACLE

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 22, No 10, 1979 pp 1205-1212 manuscript received 2 Jan 79

BODROV, V. V. and ZAICHKIN, D. I., Moscow Power Engineering Institute

[Abstract] An equation is derived which makes it possible efficiently to make numerical calculations of the attenuation factor of a spherical wave behind a single extended smooth obstacle, such as a hill, with a radius of curvature which changes smoothly and is short in comparison with the length of the route. A computer program has been developed for the algorithm worked out. The reflection of radio waves from the surface of level sections of the route is taken into account. For this purpose it is necessary to calculate the diffraction at the peak of the obstacle of several beams which arrive simultaneously at different angles. The field strength at the observation point represents the superposition of the field strengths of all the beams arriving at that point. The method of calculation selected is that of a parabolic equation in beam coordinates. It is assumed that the distance from the obstacle to the source and the observation point is significantly greater than the heights of the obstacle, the source and the observation point. In the case of an isolated inhomogeneity on the surface of the ground, up to four beams can arrive at the observation point, where three of them take into account the influence of the underlying surface. Reflection of beams at points on flat ground is taken into account by means of Fresnel reflection coefficients. The obstacle is approximated by a round impedance cylinder with a radius equal to the radius of curvature of the obstacle in the area in which the beam passes around it. The three-dimensional problem of the diffraction of a spherical wave on a round cylinder is reduced to finding a Green's function satisfying the wave equation. The total field strength at the point selected for observation is computed as the superposition of the field strengths created by each of the four beams. An expression is derived for the attenuation factor, defined as the ratio of the total field strength to the strength of the primary field. Graphs are presented which illustrate the results of numerical calculations of the attenuation factor in decibels as a function of the radius of a semicircular cylinder approximating the obstacle. Calculations were made for vertical and horizontal polarization and for two characteristic altitudes for the location of the transmitter and observation point. When the transmitter and observation point are located on the ground, the point at which the field strength is read lies in the shadow of the hill. When the direct beam and the beam reflected from the level section of the route combine in phase, if the level section is not shaded by the obstacle, the field strength at the reading point is approximately equal to double the strength of the primary field if the obstacle is of low height. In the microwave band the heights of the source and

observation point usually lie somewhere between these two cases. The curves make it possible to conclude that with low heights of the source and observation point with an increase in the dimensions of the obstacle the field behind it increases, i.e., the effect of amplification by the obstacle is at work. With great heights of the source and observation point an increase in the size of the obstacle results in reduction of the field. The magnitude of the attenuation factor with small diffraction angles is determined chiefly by the shading effect of the obstacle, which effect is described by means of Fresnel integrals. The diffraction correction taking into account the curvature and material of the obstacle depends in a complex manner on the height of the obstacle, its material and its curvature, and is of a different value for vertical and horizontal polarization. The authors thank G. T. Markov for interest in the work and constructive suggestions expressed in the process of its consideration. Figures 6; references 7: 6 Russian, 1 Western.
[93-8831]

USSR UDC 621.315.21

EXPERIMENTAL ESTIMATE OF THE UNUSUAL INFLUENCE OF AN IKM-120 AND A K-60

Moscow ELEKTROSVYAZ in Russian No 12, 1979 pp 29-31 manuscript received 8 Jun 79

TSYM, A. YU. and KONOFOL'SKIY, V. A.

[Abstract] When the older K-60 transmission system equipment is replaced by IKM-120 secondary digital signal transmission equipment, for some time one or more pairs in a cable will carry signals from the new apparatus while the others still carry signals from the K-60. This results in mutual interference between the digital and analog transmission systems. This article studies the degree and nature of this interference. In the worst case, noise power can be brought down to the maximum permissible level by connection of prediction circuits with attenuation of 5 dB at 252 KHz if the length of the sectors between amplifier points is over 20 km. In a more realistic case, analysis of a stochastic model of mutual influence showed that the signal quality meets the norms without addition of hardware. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 2; references: 4 Russian.
[113-6508]

USSR UDC 621.315.21

RELATIONSHIP BETWEEN VARIOUS TYPES OF INTERFERENCE IN THE REGENERATION SECTION OF A BALANCED CABLE

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 1-7 manuscript received 17 May 78

KAMALYAGIN, V. I. and TSYM, A. YU.

[Abstract] In transmission systems, the total maximum noise standard of a line is distributed among various types of noise. The relationship between the numerical values of various types of noises is also important for digital transmission systems. The probability of accurate transmission in digital communication systems is determined primarily by the probability of transmission in each regeneration section. A classification of noise as encountered at a regeneration section is presented. The noise power generated by each type of noise is mathematically determined. The technological tolerances which determine the basic parameters of the cable are considered in developing noise standards. It is noted that the strict solution of the problem of distribution of standard noise must be formulated as a search for the global optimum based on the criterion of minimum cost of the entire communication line. This is one of a number of papers concerned with digital communications systems which are publiched in the above issue of ELEKTROSVYAZ'. Figures 3; tables 2; references 12: 7 Russian, 5 Western.
[113-6508]

USSR UDC 621.371.22

SOME PROPERTIES OF OPTIMAL ORTHOGONAL EXPANSIONS OF THE REFRACTIVE INDEX AND ABSORPTION COEFFICIENT OF RADIO MICROWAVES IN THE ATMOSPHERE OF EARTH

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 10, 1979 pp 1281-1283 manuscript received 3 Jan 79

DROBYSHEVICH, V. I. and NAUMOV, A. P., USSR Academy of Sciences Siberian Division Computer Center and Scientific Research Radio Physics Institute

[Abstract] Expansions in terms of specific orthogonal systems of basic functions are used as convenient approximations of altitude dependences of refractive indices and absorption coefficients in the atmosphere when solving problems relating to the propagation of radio microwaves in the atmosphere of Earth. Based on statistical data on radio air sounding in the central area of the European sector of the USSR, a determination has been made of optimal orthogonal systems of functions for the absorption

coefficient and refractive index in the microwave band for different seasons of the year and for different wavelengths for the absorption coefficient. If the basis functions are designated by means of $\Psi_K^f(h)$ where h is the altitude, then instantaneous realization of function f(h) are represented as $f_m(h) = \overline{f(h)} + \sum_{K=1}^{m} c_K^f \Psi_K^f(h)$. The assignment of coefficients c_K determines the deviation of the altitude profile under consideration, f(h), from the mean profile of $\overline{f(h)}$. These coefficients are determined from the equation $c_K^f = \int_a^b [f(h) - \overline{f(h)}]\Psi_K^f(h)dh$, where segment [a,b] determines the region of assignment of function f(h). The statistical universality of eigenvectors Ψ_K^f has been established for atmospheric meteorological elements such as temperature and specific humidity. Since the radio characteristics of the atmosphere in the microwave band are determined considerably by meteorological parameters, an investigation is made here of the degree of statistical stability of optimal orthogonal expansions for the refractive index and absorption coefficient which have been arrived at. Coefficients of expansions for the absorption and refraction characteristics were computed according to the equation for c_K^f above for systems of eigenfunctions $\Psi_{K,\lambda}^{\gamma}$ and Ψ_K^N for these functions arrived at for the same seasons and wavelengths for which the corresponding radio characteristics of the atmosphere were considered and for systems arrived at for another season or for other wavelengths in the season considered, or with the simultaneous lack of agreement of seasons and wavelengths. Here γ represents the absorption coefficient, λ is the wavelength and N is the refractive index. Values of $c_{K,\lambda}^{\gamma}$ were computed at wavelengths of 0.33, 0.8 and 3 cm appropriate for radio windows of Earth's atmosphere and for regions of molecular resonance of H_2O and O_2, i.e., 1.35 and 0.562 cm. An estimate was made of the root-mean-square errors in reconstruction of altitude profiles of the refractive index and absorption coefficient in relation to the corresponding values computed directly from the results of aerological sounding of the atmosphere to altitudes of 16 km. Numerical experiments were conducted for approximately 100 results of aerological sounding in each of two seasons, the summer and winter. In general, sufficiently high statistical stability of the respective optimal basis systems is found. It is concluded that the results arrived at must be taken into account in the practical utilization of the expansions used here for the absorption coefficient and refractive index of radio waves in the microwave band. References: 4 Russian.
[93-8831]

USSR UDC 621.391.2

DEFINITION OF THE CONCEPT OF HILBERT SIGNAL DELAY AND METHODS OF MEASURING IT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 204-205 manuscript received 12 Jun 78

KRYLOV, V. V. and PONOMAREV, D. M.

[Abstract] The problem of defining the concept of signal delay for an arbitrary waveform relative to a fixed instant taken as time zero is considered within the framework of an approach based on Hilbert transformation. A set of U signals is considered, each of which can be treated as the response of some linear steady-state dynamic system to a delta-shaped pulse. The following three definitions are examined: 1) Minimum-phase signals have zero Hilbert delay relative to time zero; 2) The maximum-phase component of the signal is called the function of indeterminacy with respect to Hilbert signal delay; and 3) Hilbert delay of the signal relative to time zero is defined as the position of the maximum of the function of indeterminacy of delay. The authors thank V. G. Glebovich for continued assistance and support of the work. Figures 2; references: 3 Russian.
[123-6610]

USSR UDC 621.391.2

THRESHOLD DETECTION OF BINARY OPTICAL SIGNALS IN A QUANTUM COUNTING SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2021-2026 manuscript received 9 Aug 78

DERYUGIN, I. A., KURASHOV, V. N , MIRZAYEV, AS. T., MIRZAYEV, AG. T. and MASHCHENKO, A. I.

[Abstract] Under consideration are binary discrete systems with passive pauses and threshold detection using high-speed photoelectric counters. The optical channel with additive noise includes a modulator controlled by information carrying signals from a laser and a photodetector operating in the one-electron mode. The modulator generate "1" pulses with "0" pauses in transmission. The number of photoelectrons recorded during one pulse is compared with a preset discrimination level in a threshold device and a "1" or a "0" respectively appears at the output. The theory of such a system was verified by a simulation experiment in which the error characteristic, namely the weighted sum of "false alarm" and "missed hit" probabilities of "1" detection has been verified for several typical signal and

noise mixtures. Close agreement has been found in the cases of an amplitude-stabilized signal in noise with a Poisson distribution and a coherent signal in noise with a Rice distribution. Wide discrepancies have been found in the cases of a coherent signal or a narrow-band Gaussian signal in narrow-band Gaussian noise. This must be taken into consideration when signals appear at the detector with noise caused by scattering of laser radiation by a diffuser. Figures 6; references 8: 4 Russian, 4 Western.
[118-2415]

USSR UDC 621.391.2

STABLE DETECTION OF A QUASI-DETERMINISTIC SIGNAL IN THE PRESENCE OF MULTIPLICATIVE INTERFERENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2035-2042 manuscript received 10 Jan 77

ALEYNER, R. SH.

[Abstract] Stable detection of a quasi-deterministic useful signal is considered in the case where random Gaussian additive interference appears along with deterministic modulating multiplicative interference. The analytical form of the latter interference is assumed to be a' priori unknown. On the basis of the maximum-likelihood criterion established for his case, the estimator efficiency is evaluated as a function of the scalar products of coefficients characterizing the distributions of signal components and a detector is found immune to multiplicative interference. Figures 1; references: 11 Russian.
[118-2415]

USSR UDC 621.391.2.029.7

INTERFERENCE IMMUNITY OF CODE MESSAGE RECEPTION IN OPTICAL COMMUNICATION LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2139-2142 manuscript received 30 Jan 78

BORISOV, E. V.

[Abstract] Optical communication lines with pulse position modulation for transmission of code messages are considered and the probability of reception

error is estimated for the case of strong signals, relative to the noise, with an approximately Gaussian decoder. It is found that the mean error probability, can be reduced by simultaneously shortening the pulse duration and raising the transmitter peak power. The effect of inaccurate cadence synchronization on the mean probability of reception error is evaluated from the asymptotic expansion of erf(x) for large values of the argument. The effect of fluctuations of the optical radiation intensity in a turbulent atmosphere is evaluated, assuming a normal distribution of the logarithm of the relative radiation amplitudes. The results indicate the degree of interference immunity in such communication systems. Figures 3; references 5: 3 Russian, 2 Western (translated).
[118-2415]

USSR UDC 621.391.63

DIRECT TRANSMISSION OF IMAGES OVER A SINGLE FIBER WITH THE AID OF SPECTRAL DEVICES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2014-2020 manuscript received 9 Jan 78

DERYUGIN, L. N., CHEKAN, A. V. and DEMCHENKOV, V. P.

[Abstract] Direct transmission of optical images, without intermediate conversion to and from radio signals, is considered as a possible application of fiber optics. Each resolvable element of an image has a definite optical frequency assigned to it and all the elementary images are focused, by means of a dispersing device, on the same area element of the focal plane (tip of a single fiber). The principle of this spectral method using a single channel is demonstrated on the transmission of first one black-and-white line and then a two-dimensional pattern. An analysis of the capability and the resolving power indicates that prisms and diffraction spectroscope are most suitable for implementing this method of image transmission. The effect of velocity dispersion in the transmission channel and the intensity relations characterizing such a system have been verified experimentally, as illustrated by a typical photograph of a text taken across a 50 cm long fiber 60 μm in diameter. Figures 3; references 6: 5 Russian, 1 Western.
[118-2415]

USSR UDC 621.391.833.2:510.5

AN ALGORITHM OF COMPUTER-AIDED RECEIVER ADAPTATION TO CHANGES IN THE STATISTICAL CHARACTERISTICS OF INTERFERENCE POWER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79 pp 2043-2052 manuscript received 21 Aug 78

SINDLER, YU. B.

[Abstract] A receiver of a signal array with interference is considered which decides between two alternative hypotheses and a rejection, the rejection zone for each elementary signal in the array having a controllable width. The interference is assumed to have a normal or another given distribution, but its power to have some a' priori unknown random distribution. This receiver can be a radar receiver cyclically scanning a spatial sector which consists of N_m directions and testing each direction for presence or absence of a target. An algorithm of receiver adaptation is constructed which consists of data preparation with necessary preliminary operations and solution of a minimization problem to determine the optimum threshold function after reception. This algorithm which adapts such a receiver to changes in the distribution of interference power, is written for a computer, is modifiable for better precision, if necessary, and takes into account the error of interference power measurement. Figures 2; tables 2; references: 7 Russian, 1 Western (translated).
[118-2415]

USSR UDC 621.391.833.44

EFFECT OF INTERRUPTION IN A DIGITAL SIGNAL ON OPERATION OF THE CLOCK FREQUENCY SEPARATOR IN A REGENERATOR

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 19-21 manuscript received 1 Mar 79

KORDONSKIY, E. V. and PODBEREZIN, D. A.

[Abstract] Digital transmission system regenerators usually operate such that a failure of the clock signal generator results in complete loss of the signals passing through the line. A study is made of the effect of interruptions in the digital signal on the operation of clock signal separator circuit. The result is interruptions in communication, consisting of interruption in the clocking oscillation and slipping of the clock. Equations are generated for such cases allowing the variation of the maximum permissible duration of input signal loss without interruption of communication on the quality of the clock frequency separator circuit. This is

one of a number of papers concerned with digital communication systems which are published in the above issue of ELEKTROSVYAZ'. Figures 4; references 3: 2 Russian, 1 Western.
[113-6508]

USSR UDC 621.391.883.3

FACTORS DETERMINING THE QUALITY CHARACTERISTICS OF STATISTICAL TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 13-16 manuscript received 3 May 79

GORDIYENKO, V. N. and SLASHCHEV, V. N.

[Abstract] Digital statistical transmission systems based on delta modulation are discussed. The basic sources of distortion in such systems are reported. The influence of overloads on the quality of transmission of speech is analyzed. Overloading the group line has the greatest influence on transmission quality. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 6; tables 1; references 6: 3 Russian, 3 Western.
[113-6508]

USSR UDC 621.395.4(0.88.8)

TRANSMISSION OF A SUBSCRIBER SIGNAL THROUGH A DIGITAL NETWORK USING GTS CABLES

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 35-38 manuscript received 7 Jun 79

GURVICH, L. N.

[Abstract] When electronic switching systems (EKS) are first installed, it is frequently necessary to run extended subscriber lines over the cables of the city telephone service (GTS), such as the model T or TPP. The cost of line equipment becomes significant because the subscriber lines are at first individual. The use of biimpulse relative code is quite promising for use in such individual subscriber lines, because of the simplicity of transformations involved and the ability to use predistortion to maintain

communication quality while transmitting signals over city telephone lines with up to 40 dB attenuation at 48 KHz and to simplify regenerating receiver equipment. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 8: references 6: 5 Russian. 1 Western.
[113-6508]

USSR UDC 621.395.44:621.376.5

A RURAL LOOP TRANSMISSION DISTRIBUTION SYSTEM BASED ON DELTA MODULATION

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 9-12 manuscript received 23 May 79

ALEKSEYEV, YU. A., CHERNYSHOV, L. A. and SHTEYN, V. M.

[Abstract] Some trends in the development of rural communications abroad are briefly noted. The Bell Laboratories SLC-40 system is used as a standard of comparison. A trend toward decreasing channel speeds and increasing numbers of channels, and the specifics of loop distributing systems with delta modulation are noted. Structural diagrams of systems are presented. A system is proposed to satisfy the demands of rural communications while achieving greater economy of hardware and cable, more expedient time distribution, greater net viability, easier servicing and lower cost of spare parts. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 4; references 8: 2 Russian, 6 Western.
[113-6508]

USSR

PROBLEMS OF INTRODUCING PULSE-CODE MODULATION EQUIPMENT

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 p 23

LIFSHITS, V. M., deputy chief, Odessa Division of Central Scientific Research Institute of Communications [TsNIIS]

[Abstract] The author discusses 10 years of progress in introducing the IKM-12M equipment with pulse-code modulation (PCM) and digital separation of channels for transmission in rural telephone networks. The most

successful procedure is to concentrate initial efforts on one territory that is most nearly ready for digital transmission equipment, setting up a kind of "school" where communications workers can train for introduction of the PCM equipment in the rest of the region. It is suggested that zonal laboratories could be of considerable assistance in this program. Further work is needed in automating operation of the new transmission systems, and improving the technical level of utilization of the new equipment in rural areas. Figures 1.
[92-6610]

USSR UDC 621.395.721:621.395.74.0.37.372

HARDWARE FOR CONNECTING SUBSCRIBERS SIGNALS IN THE AVG-60 DIGITAL COMMUNICATION NETWORK

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 16-19 manuscript received 20 Jun 79

ABUGOV, G. P., LUK'YANOV, YU. I., RAKHMAN, A. M. and ALEKSANDROV, A. YE.

[Abstract] In the integrated digital communication network with delta modulation, universal communication channels are created by allocating digital streams at 32 kbit/s directly to subscriber apparatus. The use of 4-wire lines for 2-way transmission of digital data and the great bandwidth makes these lines more expensive than ordinary analog telephone lines. However, these superior lines can be used to transmit group signals and thus may actually be cheaper than analog lines if the distance over which an individual line to an individual subscriber travels is less than 400 meters or so. The AVG-60 apparatus is used to combine 60 such digital lines into a group line of 2048 kbit/s by time group formation. A structural diagram and photograph of the AVG-60 are presented. The AVG-60 is but one type of apparatus for subscriber group formation. Others include the AVG-15 for 15 subscriber lines and the R-60, which can separate 5 to 10 subscriber lines from a 2048 kbit/s signal along a group line up to several tens of kilometers in length. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 3; references: 3 Russian.
[113-6508]

USSR UDC 621.396.94:537.874.4

PROPAGATION OF MODULATED WAVES IN A TURBULENT ATMOSPHERE. PHASE FLUCTUATIONS OF THE MODULATING WAVEFORM ON A TRANSMISSION PATH WITH REFLECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 188-190 manuscript received 7 Oct 77

LUKIN, I. P.

[Abstract] Optical waves propagating in the ground layer of the atmosphere are perturbed by turbulence, which results in amplitude and phase fluctuations. Fluctuations of wave parameters cause an increase in noise level in optical communication lines, and also increase errors in electronic ranging and direction finding. The author shows that a method based on weak selectivity of turbulence can be used to reduce the influence of this factor in communication and locating systems. In the proposed technique, the carrier field is amplitude-modulated by a sine-wave signal, and measurements are made on subcarriers rather than on the fundamental frequency, thus eliminating in large measure the distortions caused by turbulence. References: 7 Russian.
[123-6610]

USSR UDC 621.396.96.01

WEIGHTED PROCESSING OF A SHORT-BASE SIGNAL WITH LINEAR FREQUENCY MODULATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 106-110 manuscript received 11 Oct 78

KNYSHEV, I. P.

[Abstract] The main disadvantage of signals with linear frequency modulation is the considerable level of the side lobes in the output signal of the matched filter. Previous research on side lobe suppression has assumed a long signal base (product of signal duration by spectrum width B = FT). In this paper the author examines the peculiarities of processing short-base signals with linear frequency modulation for purposes of getting low side lobe levels. It is shown how weighted processing of a compressed signal can be used for side lobe suppression, and the requirements to be met by the weighting filter are determined. A simplified expression is derived for theoretical evaluation of the level of side lobes at the output of the weighting filter by using the method of paired echos. Figures 5; references: 3 Russian.
[123-6610]

USSR UDC 621.396.96:621.391.26

OPTIMUM MULTICHANNEL DETECTION AND DIFFERENTIATION OF QUASI-DETERMINISTIC SIGNALS AGAINST A BACKGROUND OF GAUSSIAN INTERFERENCE WITH UNKNOWN INTERCHANNEL CORRELATION MATRIX

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 85-92 manuscript received 17 Jul 78

KORADO, V. A.

[Abstract] In a previous paper ("Radiotekhnika i elektronika," Vol 23, No 2, 1978, p 326) this author considered the problem of multichannel detection of a quasi-deterministic signal against a background of gaussian interference with an unknown interchannel correlation matrix according to a minimax criterion. This work is now generalized to the case of multiple-alternative detection and differentiation of signals. The optimum solution is found for the problem of detecting and differentiating signals of unknown intensity from finite discrete multidimensional sampling of the complex amplitudes of input waveforms against a background of gaussian interference with unknown interchannel correlation matrix. Minimax resolving rules, and also locally and asymptotically minimax resolving rules that have a fixed probability of false alarm are found for signals with deterministic and random amplitudes. Multiple-alternative resolving rules are given for the maximum likelihood, and some quasi-optimum resolving rules are also given. Some possible generalizations of the results are mentioned. References 10: 5 Russian, 5 Western.
[123-6610]

USSR UDC 621.398:681.7.068

FIBER OPTICS SUBSCRIBER COMMUNICATION LINE

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 42-43 manuscript received 25 Oct 78

ZARKEVICH, YE. A., KOROTICH, A. G. and USTINOV, A. S.

[Abstract] The process of creation of equipment operating on an optical cable requires the solution of a number of problems resulting from the specifics of fiber optics elements. The great nonlinearity of the characteristics of radiators and photodetectors complicates the transmission of analog information through optical cables. A device has now been developed which can be used to connect telephone equipment to city automatic telephone exchanges through optical cables. The device operates by digital transmission of telephone messages with noncompanded delta modulation, using

rather simple coders and decoders. The device is designed for operation through 3-core optical cables, one of which is used for transmission of the clock pulse. A model of the device has been tested and the quality of its operation found satisfactory. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 1; references: 3 Russian.
[113-6908]

USSR UDC 656.25:621.315.22

A COMBINED AUTOMATION AND COMMUNICATION CABLE FOR RAILROAD LINES

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80 pp 4-6

GAVRILYUK, V. V., candidate in technical sciences, senior scientific research worker, VNIIZhT [All-Union Order of the Red Banner Scientific Research Institute of Railroad Transportation]; PAKHOMOVA, L. I., senior engineer, Main Administration of Signalization and Communication, Ministry of Railroads; KONOVIN, M. G., section chief, Berdyansk department, VNIIKP [All-Union Scientific Research, Planning Design and Technological Institute of the Cable Industry]; MALUCHINSKAYA, A. N., director of laboratory, VNIIKP; and URIBUTA, M. A., chief, Laboratory of the "Azovkabel'" Plant

[Abstract] A new combined automation and communication cable for railroad lines has been developed on the basis of VNIIZhT requirements. The cable consists of two coaxial pairs, one low-frequency quad at the center of the core, two symmetric pairs of high-frequency quads, five signal conductor pairs, and one test conductor. Both pairs of high-frequency quads are for multiplexing, one with K-60p or with IKM-120 pulse-code-modulation equipment, one with K-24T or with K-12+12 equipment. The two coaxial pairs can be used for multiplexing with K-300p, N-960 (Finnish), K-1020p, K-1920p or with IKM-480 pulse-code-modulation equipment. The cable serves a 6.7 km long construction line for multichannel analog and digital transmission, with repeaters as far as 17-18 km or as near as 2.12-2.25 km apart depending on the type of equipment. The performance characteristics of this MKKPAB cable have been measured and the design of strands optimized in terms of cost as well as reliability. Figures 4; tables 1.
[124-2415]

USSR

VKPA UNICOAXIAL CABLES

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 17-18

FROLOV, P. A., candidate of technical sciences, senior scientific research worker, Central Scientific Research Institute of Communications [TsNIIS], INYUSHIN, YE. I., deputy laboratory chief, and KUPINSKIY, B. S., senior engineer

[Abstract] The highly economic K-120 transmission system that operates on VKPA-2.1/9.7 unicoaxial cable is being more and more widely used in zonal communication networks. This type of cable is produced in various modifications for different kinds of applications: buried telephone cable (VKPAP); rodent-proof cable (VKPAPB, VKPAPBShp, VKPAPStShp); cable for river crossings (VKPAPKShp); for overhead communication lines with normal span (VKPAPt) and with long span (VKPAPut). The 2.14 mm inner conductor is insulated by porous polyethylene plastic from the aluminum outer conductor. The outer insulation, armoring and reinforcement varies depending on use. Diagrams are given showing the configuration of outer shells for all cable types. The inner conductor is rated at 5.15 ohms/km, and the outer conductor is rated at 1.5 ohms/km at 20°C. Insulation between conductors is rated at 10 kilohms/km, and the outer insulation is rated at 5 megohms/km. Wave impedance is 75 ohms. The insulation of the coaxial pair must withstand a potential of 3000 V for two minutes. Figures 3; tables 1.
[92-6610]

USSR UDC 656.222.2:629.4.052.3

REMOTE CONTROL OF AUTOMATIC BRAKES IN TANDEM TRAINS FROM ZhR-UK-LP RADIO STATIONS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80 pp 8-10

ANDRUSHKO, N. S., senior engineer VNIIZhT [All-Union Scientific Research Institute of Railroad Transportation]; VAVANOV, YU. V., laboratory chief, Candidate in Technical Sciences; and VASIL'YEV, O. K., laboratory chief, Candidate in Technical Sciences

[Abstract] Tandem hookup of freight trains, with one locomotive at the head and another one in the middle is an effective way to increase the efficiency of cargo movement. An important problem in such a system is coordination of control activities and especially of braking action, which must be synchronized. Automatic brakes with remote control of a three-way cock ("brake", "release", "extraneous braking") have been developed with

a radio communication system between the two locomotives. This system includes ZhR-UK-LP receiver-transmitter stations with a remote control channel from the driving end to the driven end and with a remote signalization channel in the opposite direction. This system of remote control of automatic brakes is compared with the USA-Canadian "Locotrol" system as well as with the French and the West German systems in terms of design and performance parameters. The telephone channel between both ZhR-UK-LP radio stations operates in the 300-3000 Hz frequency band, with nonlinear distortions not exceeding 14 percent and nonuniformity of the amplitude-frequency characteristic not exceeding ±6 dB within this band. Figures 1; tables 2; references: 3 Western.
[124-2415]

USSR UDC 656.254.15.29:621.395.4

ORGANIZATION OF COMMUNICATION WITH AN OPERATOR OVER HIGH-FREQUENCY WIRE CIRCUITS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80 pp 39-40

OVCHAROV, A. D., engineer, Tichlik range, Central Asian Railroad

[Abstract] An emergency along a range that is not continuously supervised requires communication with an operator along the boosting range and, when the high-frequency equipment fails, this can be organized over the high-frequency wire line via a telephone system coupled to the latter through line filters. For this purpose, an attachment consisting of four hermetically enclosed 24 V relays has been built which operates in a 2-way telephone system between two points through a switching station. Either an M-60 or an URTS commutator is suitable here, both having already performed well for over a year on a 180-km long line with bimetallic conductors 4 mm in diameter. Figures 2.
[124-2415]

USSR

NEW HIGH-STRENGTH STEEL-ALUMINUM WIRE FOR OVERHEAD COMMUNICATION LINES

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 p 24

LYSAYA, A. I., senior science worker, KONIIS [Kiev affiliate of Central Scientific Research Institute of Communication], DOROSHENKO, N. V., laboratory chief, BRITVICH, V. A. and FEDORCHENKO, V. F., chief engineers

[Abstract] Research to find materials for wire that would meet all requirements with respect to electrical, mechanical and corrosion parameters, without relying on scarce and expensive raw materials, has led to development of bimetal steel-aluminum wire made by plating a steel core with 0.3-0.5 mm of aluminum. This wire is made by powder metallurgy methods in the USSR. The grade of this wire is BSA-KPL, which is almost as good as Alyumovel'da, and is considerably cheaper. High-strength BSAV wire of this type is now being developed with diameter of 4.3 and 5.1 mm. The mechanical properties of the new wire are on a level with BSM wire. The core will be hot-rolled grade 40-60 steel with a 10-12 μm zinc sublayer.
[92-6610]

USSR UDC 681.327.8:621.376.56

ASYNCHRONOUS INPUT OF MULTIPLEXER SIGNALS INTO DIGITAL LINES

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 38-41 manuscript received 24 Nov 78

SARAYEV, V. N.

[Abstract] Asynchronous input of a group signal to a digital line can be achieved using a multiplexer synchronizing channel. A general algorithm for determination of the synchronization signal shift is outlined. Two possible types of group signals are analyzed: concentrated cycle synchronization signals and distributed cycle synchronization signals. The method of matching of speeds of the multiplexer with the IKM-30 pulse-code modulation apparatus with changing line length can be used for asynchronous input of group multiplexer signals to digital lines. The advantages of this method include high interference stability, lack of need for a special service channel, as well as simplicity of design of the asynchronous input apparatus which in this case may be a component part of the cycle synchronization system of the multiplexer. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 1; references: 5 Russian.
[113-6508]

USSR

TERMINAL COMMUNICATION SET TO REPLACE DISTRICT SELECTORS BASED ON DECADE STEP-BY-STEP SWITCHES

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 29-30

PEVTSOV, N. V., chief engineer, Leningrad Long-Distance Telephone Office [MTS], and SHMIDT, YE. L., laboratory chief

[Abstract] The paper describes a terminal communication set developed by A. D. Ginzburg, Sh. G. Solov'yev and Ye. L. Shmidt of the Leningrad MTS, which replaces district selectors based on decade step-by-step-switches without modification of existing equipment or any corrections in technical documentation. A schematic diagram of the circuit is given and explained. One standard bay can accommodate 120 of the new terminal sets, replacing 12 bays of the outmoded district selector units. Experimental models of these sets are now in operation in the USSR, have been almost trouble-free, and require little maintenance. Figures 2.
[92-6610]

USSR

UPDATING THE YAKOR' RADIO-TV STATION

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 25-27

FRIDMAN, E. M., chief of the central laboratory, Soviet-Wide Radio-TV Transmitting Station [ORPS], and ORLOV, V. V., chief specialist of the central laboratory

[Abstract] The paper describes the comprehensive updating of the Yakor' television transmitters now being carried out by the central laboratory of the Soviet-Wide Radio-TV Transmitting Station. When the program has been completed, it will be possible to operate these transmitters in the unattended mode. The first stage of the work has been completed: the output stages are simpler and more stable, and also more repairable, the number of alignment operations has been reduced, and there has been an improvement in the operating reliability of the station as a whole. The mean time between failures has been increased from 175 to 250-260 hours. The second stage of the program has started with conversion of the final stages to a circuit with two dead-grounded grids, and also redesign of the power supply system. The most urgent problem at present is precorrection of the video signal. Figures 5; tables 1.
[92-6610]

USSR

MATRIX SWITCHING EQUIPMENT FOR QUASI-ELECTRONIC MUNICIPAL, INTERCITY AND DIAL PBX SYSTEMS AND JUNCTIONS

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 21-22

KOBLENTS, YA. G., chief designer of the Leningrad Division of the Central Scientific Research Institute of Communications [TsNIIS]

[Abstract] The paper describes a new type of "ferride" matrix switching element used in the commutation fields of quasi-electronic dial exchanges. Each matrix is equivalent to a sealed-contact relay with magnetic interlock. The basis of the unit is a sheet of magnetically soft material that is common to all commutation points. Fastened to the plate is a variable magnet with coercive force of the order of 35-40 oersteds. In contrast to conventional ferrides, the sealed contacts are located outside of the winding and the magnetic fields of the core are fed to the working gap of the contacts by magnetic circuits of a magnetically soft material. On this core are two windings. Each winding is broken up into unequal sections of N and 2N turns, wound from different sides of the shunt plate in opposite directions. Each winding corresponds to one of the coordinates of the matrix along the horizontal and along the vertical. The windings are made without a break in the wire within the limits of the given coordinate. This arrangement provides a differential circuit for controlling the commutation point. If a current pulse is sent to only one of the windings, the sealed contacts will be pushed open, but if the pulse goes simultaneously to both windings the sealed contacts will be closed. These ferride commutation points are assembled into MS-F plug-in matrix connectors. A table is given summarizing the technical specifications. Figures 4; tables 1.
[92-6610]

USSR

PROSPECTIVE SIGNAL SYSTEMS, AND STAGES OF INTRODUCTION ON TELEPHONE NETWORKS

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 18-21

ZHARKOV, M. A., laboratory chief, Central Scientific Research Institute of Communications [TsNIIS]

[Abstract] The author discusses systems for transmitting line signals and control signals in telephone communication networks. In decentralized systems the signals are transmitted over each individual channel or line,

and therefore the cost and volume of equipment are practically proportional to the number of channels or lines. The centralized system provides transmission of control and line signals separately from the talk channel through a common signal channel. Signal generation, shaping and transmission is handled by a common central device that serves a group of talk channels. The individual equipment is reduced to a minimum and is used only for transmitting certain acoustic signals and for balancing level diagrams. Decentralized systems that are now being used have the disadvantages of comparatively slow signaling, a limited number of signals, interference from speaking currents, and inadequate immunity to intentional interruptions. These deficiencies will be overcome in future decentralized systems by individual signal channels used in electronic and quasi-electronic commutation systems with programmed control. Replacement of dialing by touch-tone, combined with conversion from centralized to individual signal channels should reduce the time for making telephone connections from the present 20-30 s to 2 s. Figures 4.
[92-6610]

USSR

HOW TO IMPROVE THE QUALITY AND RELIABILITY OF RURAL WIRE BROADCASTING

Moscow VESTNIK SVYAZI in Russian No 11, Nov 79 pp 12-14

VDOVUSHKINA, G. S., chief of the radio and television service of Tula
OPTUS [expansion unknown]

[Abstract] A review of the program on improving the quality and efficacy of rural wire broadcasting networks with loudspeakers in homes in Tul'skaya Oblast since 1975. This program began with development of a network for rural broadcasting to every kray. Provisions have been made for installing radio-exchange rediffusion units in large centers of population, and in the central farmhouses on collective and State farms. As a rule, newly installed radio feeder lines will be no longer than 10 km. During the last five-year plan, 23 automated radio-exchange rediffusion stations were installed, doing away with 240 km of wire-broadcast feeder lines, and increasing the saturation per km, including an additional four public loudspeakers for 1978. Improvements in broadcasting are described. Figures 4.
[92-6610]

USSR

ELECTROMAGNETIC COMPATIBILITY OF ELECTRONIC DEVICES

Moscow RADIO in Russian No 10, 1979 pp 22-24

PEREBEYNOS, K., Moscow

[Abstract] The problem of electromagnetic compatibility is briefly analyzed. It is noted that international agreements have repeatedly set forth the limits of the use of the radio spectrum, but that these agreements are frequently not observed. Some of the characteristics of the increase in the number of radio transmitters and their power are presented, particularly noting increases in the USA. It is noted that electromagnetic compatibility is not simply a problem of radio transmitters. In 1974, all medical apparatus operating in the high frequency band was turned off for a few minutes in one large industrial city as an experiment. The effect was a surprising drop in the level of radio interference throughout the city. Litton Corporation studies of the electromagnetic situation on board a naval vessel are briefly reported. No specific recommendations for improvement of electromagnetic compatibility are given, beyond increasing selectivity of receivers and reducing spurious electromagnetic radiation of all types. Figures 4.
[63-6508]

USSR UDC 621.318.134.029.64

MICROWAVE POWER TRANSMISSION SPECTRA ON MAGNETOSTATIC SURFACE WAVES IN YIG PLATES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 128-132 manuscript received 11 Oct 78

YESIKOV, O. S., TOLOKNOV, N. A. and FETISOV, YU. K.

[Abstract] The properties of magnetostatic surface waves are studied in tangentially magnetized ferrite plates in the 3-cm wave band. The measurement technique was based on using two shorted waveguides for transmitting and receiving the waves. The ferrite plate was placed parallel to the narrow wall of the waveguides with one end in the transmitting waveguide and the other end in the receiving waveguide. An electromagnet was used to set up a field of up to 5000 oersteds tangent to the plate. The microwave power transmission spectra with changing magnetic field were registered on a strip-chart recorder. Single-crystal YIG specimens were used with saturation magnetization of 1700 oersteds and uniform resonance linewidth of about 1 oersted. The transmission spectrum in the ferrite-metal structure due exclusively to the FM wave was obtained by using a microwave-absorbing coating on the free surface of the ferrite to attenuate the FD wave. The transmission spectrum was also recorded in the ferrite-dielectric-metal system. Resonances of the transmitted microwave power are observed in the region of existence of a reverse surface wave. Magnetostatic surface waves were stimulated with wave vectors of 15-260 cm^{-1}. Figures 4; references 12: 2 Russian, 10 Western.
[123-6610]

USSR UDC 621.372.8

SCATTERING OF WAVES BY ANISOTROPIC THIN LAYERS IN A PLANE WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2133-2136 manuscript received 14 Mar 78

KURUSHIN, YE. P.

[Abstract] A plane model of asymmetric striplines with semiinfinitely large inclusions is considered for describing a variety of thin-film microwave devices such as those with ferrite layers. The film is assumed to adjoin one plate of a plane waveguide filled with a dielectric medium and to be much thinner than the dielectric substrate. The problem of diffraction of a fundamental-mode wave is solved for a complete electromagnetic field on the basis of the Helmholtz equation with nonhomogeneous boundary conditions

using Fourier transforms and matrix notation. Calculations yield the reflection coefficient $|R|$ as a function of the gyromagnetic parameter $\Gamma H_0/\omega$ for a lossless anisotropic layer, for a strongly absorbing anisotropic layer, and for an absorbing thin isotropic layer. The reflection coefficient peaks lower and at lower values of the gyromagnetic parameter as the external magnetic field becomes closer aligned with the ferrite, and decreases monotonically faster with increasing saturation magnetization of the ferrite. The author thanks A. T. FIALKOVSKIY for the helpful comments. Figures 2; references 10: 9 Russian, 1 Western.
[118-2415]

USSR UDC 621.372.8.001.24

DISPERSION CHARACTERISTICS OF A FLAT METAL COMB OF FINITE WIDTH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 194-196 manuscript received 18 May 78

MYSHKIN, V. G.

[Abstract] A theory is proposed for the waveguide dispersion properties observed in the process of diffraction of oblique electromagnetic surface waves on the straight boundary between two semi-infinite ribbed metal structures of finite width with given self-reactance inscribed in a plane with ideal metallic conductivity where the ribs are normal to the boundary between the structures. The limits of applicability of the proposed theory are estimated for given reactance and waveguide width. Figures 3; references 6: 5 Russian, 1 Western.
[123-6610]

USSR UDC 621.372.8.001.34:621.315.61

INVESTIGATION OF THE FORCED SLOW-WAVE MODE IN A DIELECTRIC WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 199-202 manuscript received 27 Apr 78

BARSUKOV, YU. K. and ALEKSEYENKO, YE. F.

[Abstract] An investigation is made of a slow wave excited in a dielectric waveguide by a predetermined current. The field of the wave is represented by a set of plane waves with the same amplitude dependence on

coordinate along the waveguide axis. Waves are divided into TE, TM and induced waves relative to this coordinate, and are coupled by the rod that forms the waveguide. The equations of the coupled waves are set up by a variational method with consideration of the exciting current. The boundary conditions on the surface of the rod are not explicitly formulated. Calculations are done for a rectangular rod, enabling comparison with published results. Satisfactory agreement is observed. Figures 2; references 12: 10 Russian, 2 Western.
[123-6610]

USSR UDC 621.372.09

COMPENSATION OF A DIFFRACTED FIELD IN AN ARRAY OF PLANE WAVEGUIDES WITH INHOMOGENEITIES

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 10, 1979 pp 1255-1264
manuscript received 18 Jul 78

POLUBOTKO, A. M. and STEPANOV, V. A., Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin)

[Abstract] With the incidence of a plane wave onto an array of plane waveguides, in addition to the field passing through the system there exists a field reflected from the leading edge of the structure and this field consists of a field diverging from the structure and a field of surface waves near the surface. In a system with passive inhomogeneities added to the waveguides the field diverging from the structure can be compensated by a field reflected from the inhomogeneities and traveling back into free space. A study is made of this type of compensation. On the condition of total compensation of the harmonics diverging from the structure, conditions are arrived at which the matrix of transformation coefficients of waveguide modes in the inhomogeneities must satisfy. The diffraction is discussed of an obliquely incident wave in an array of plane waveguides with inhomogeneities when vector E is directed parallel to the structure's fins. It is assumed that the inhomogeneities are seated sufficiently deeply in the waveguides so that it is possible to disregard the scattering of unpropagated waveguide modes in an inhomogeneity and at the boundary of the structure. An inhomogeneity is characterized as a matrix of transformation coefficients of order N, where N is the number of propagated waveguide modes. Coefficients are derived for the resolution of fields in terms of space harmonics and waveguide waves. The condition for total compensation is found, which states that the number of propagated waveguide waves must equal the number of diverging space harmonics and that for the purpose of creating the necessary compensating field a number of degrees of freedom is necessary which is equal to the number of diverging

harmonics of the field. A condition is found which must be imposed on the matrix of transformation coefficients for the purpose of realizing total compensation of the diverging field, and from this condition it is obvious that total compensation can be accomplished by means of different sets of transformation coefficients. The special case of oblique incidence is discussed. The equations arrived at make it possible to create a system of inhomogeneities which ideally match the waveguide array with free space. Curves are shown, illustrating the relationship of the matrix of transformation coefficients to the angle of incidence with an indication of the region in which it is possible to accomplish total compensation of the field. With an angle of incidence of less than 30° this dependence is slight. Figures 2; references: 1 Russian.
[93-8831]

USSR UDC 621.372.413

CONTROLLING THE FIELD DISTRIBUTION OF AN E-WAVE BY MEANS OF A HIGH-Q PASSIVE RESONATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 1970-1975 manuscript received 19 Jul 78

BEZRODNYY, YU. G., BOMKO, V. A., REPALOV, N. S., RUDYAK, B. I., and KHIZHNYAK, N. A.

[Abstract] Under consideration is a cylindrical bulk resonator which retains a high Q-factor at high frequencies and under vacuum. Such a resonator can serve as a passive element for controlling the field distribution of an E-wave excited in an also cylindrical main resonator, the longitudinal axes of both cylinders being at right angles to one another and their surfaces being tangent at one point. The two resonators are electromagnetically coupled through a window cut in both surfaces around that point of tangency. The performance of this system is analyzed on the basis of the Maxwell field equations, which lead here to a nonhomogeneous wave equation for the vector of magnetic field intensity, subsequently solved for the $E_z = 0$ mode (H-solution) as well as the $H_z = 0$ mode (E-solution). The theoretical results have been confirmed by an experiment with a cylindrical E-resonator $L_1 = 800$ cm long and $D = 24.6$ cm in diameter, carrying a load in the form of a periodic structure and an H-resonator with a movable plunger for control. Figures 4; references: 6 Russian.
[118-2415]

USSR UDC 621.372.414

COAXIAL CAVITY RESONATORS (SURVEY)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 1-43
manuscript received 5 Jun 79

NEFËDOV, YE. I. and FIALKOVSKIY, A. T.

[Abstract] This is the second part of a survey dealing with coaxial cavity resonator structures. The first part was published in "Radiotekhnika i elektronika" No 9, 1979 and dealt with structures exemplified by a coaxial cavity resonator in the form of a cylinder with straight generatrices. The resonators considered in this part of the survey are typified by a coaxial disk cavity resonator. Fields of application are considered mainly in the millimeter and submillimeter wave bands. The types of resonators considered include the ring cavity, cavities based on mirrors with focusing properties and apertures, the irised line and related waveguide and tank structures, and a new type of cylindrical coaxial cavity resonator in which the central conductor is convex (barrel-shaped) rather than focusing. Waveforms of the whispering gallery type are considered in disk cavity resonators. The authors thank L. A. Vaynshteyn and B. Z. Katsenelenbaum for interest in the work. Figures 26; references 130: 108 Russian, 22 Western.
[123-6610]

USSR UDC 621.372.542:621.372.061.2

DESIGN OF A DISCRETE RESONATOR

Moscow ELEKTROSVYAZ' in Russian No 12, 1979 pp 43-45 manuscript received
12 Mar 79

SNEGOV, A. D.

[Abstract] Frequency analysis of a discrete signal can be performed using a combination of the operations of delay, addition and multiplication by a constant. This method has definite advantages. Devices which perform digital processing of actual signals are specialized computers operating in real time. Their effectiveness increases with increasing demands for accuracy of processing. This article derives equations relating the coefficients of a discrete resonator to the electronic parameters of a filter, and also presents a method for design of arrays of filters with identical amplitude-frequency characteristic maxima. The results produced in the article are correct for analog, digital and discrete (frequency limited

but not quantized) signals. This is one of a number of papers concerned with digital communications systems which are published in the above issue of ELEKTROSVYAZ'. Figures 2; references: 2 Russian.
[113-6508]

USSR UDC 621.372.822

DISTRIBUTION OF A MICROWAVE ELECTRIC FIELD INSIDE AND OUTSIDE OF A SEMICONDUCTOR ROD PLACED IN A RECTANGULAR WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 197-199 manuscript received 4 Apr 78

KNISHEVSKAYA, L. V., KOTOV, M. N. and YARMALIS, M. M.

[Abstract] An integral equation method is used to solve the problem of finding the electric field distribution for a rod of arbitrary cross sectional shape and dimensions placed in a rectangular waveguide perpendicular to the wide wall and interacting with the H_{n0} mode. The field at a given point is described by an integral equation with a Green function represented in terms of waveguide modes. This equation is converted to a system of linear equations by the net-point method, and the resultant system is then solved on a digital computer by Seidel's interation technique. The method is illustrated by solving the problem for a square rod with sides parallel to the walls of the waveguide. The theory agrees qualitatively with experimental data, although there is a 10-20 percent discrepancy. The authors thank V. K. Shugurov for discussing the results. Figures 2;;references 8: 7 Russian, 1 Western.
[123-6610]

USSR UDC 621.372.822.001=621.372.821

ACCOUNTING FOR THE SINGULARITY AT THE EDGE IN SOLUTION OF THE PROBLEM OF DIFFRACTION ON AN IRISED COUPLING BETWEEN FLAT WAVEGUIDES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 190-194 manuscript received 13 Apr 78

LYAPIN, V. P. and SINYAVSKIY, G. P.

[Abstract] One way to improve convergence in the method of partial regions used in solving various problems of electrodynamics is to account for the edge singularity of field behavior. In this paper the authors examine the application of this technique to the problem of an irised coupling between two flat waveguides with incidence of a TM- or TE-polarized wave. It is shown that this approach ensures rapid convergence of approximate results to the exact solution, and thus reduces the order of the system of equations being solved. This procedure can be used to figure thin and thick irises in a rectangular waveguide, interdigital delay-line systems, couplings, waveguide shifts and so on. Figures 1; tables 4; references: 5 Russian. [123-6610]

USSR UDC 621.396.677.71.001.24

WAVEGUIDE CHARACTERISTICS OF METAL-DIELECTRIC OPEN CYLINDRICAL TRANSMISSION LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79 pp 1949-1959 manuscript received 22 Jun 78

NOSICH, A. I. and SHESTOPALOV, V. P.

[Abstract] Transmission lines are considered which consist of thin ideally conducting sheets around, but not completely around, circular or semi-circular cylindrical dielectric rods. Such structures serve as effective exciters of surface waves. The presence of curving conductor surfaces and of curving boundaries between two different dielectric media, rod and air, improves the transmission characteristics. This is demonstrated here on the basis of a rigorous analysis involving diffraction of a fundamental-mode wave at open surfaces. The fundamental equation of wave dispersion is, accordingly, formulated first for a partially shielded circula dielectric rod, for an exponentially narrow slit, and for an open stripline on a bounded substrate. Metal tape around a dielectric rod is found to slow down a fundamental-mode wave and thus to concentrate its field near that rod. Figures 3; references 12: 11 Russian, 1 Western. [118-2415]

USSR UDC 656.25:621.318

USE OF LIQUID-METAL CONTACTS IN SWITCHING DEVICES

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80 pp 45-47

KONDRATENKO, L. P., dotsent, LIIZhT [Leningrad Institute of Railroad Transportation Engineers], Candidate in Technical Sciences, MOLODTSOV, V. P., laboratory chief, Candidate in Technical Sciences, PRYNTSEV, V. A., graduate student

[Abstract] Scarcity of silver is stimulating the development of new miniature and reliable electromechanical relay devices. Liquid-metal contacts have been developed during the nineteen sixties and seventies in the USA as well as in other countries including Japan. Most widely used are mercury tilt switches, with an inert gas and a mercury droplet filling a hermetically sealed mechanical strong glass or metal bulb with two stationary electrodes inside. The basic performance parameters of these contactrons are the differential angle between make and break positions, designed to be from as small as 0.1° to as large as 90°, and the life now reaching a level of $5 \cdot 10^5$ cycles under a nominal load. A modification to this are magnetically controlled reed switches with a movable electrode attracted to a stationary one to form a capillary for the mercury to rise, usually for vertical mounting. Another modification are magnetically controlled plunger switches with a movable plunger of a magnetic material between two stationary nonmagnetic electrodes causing the mercury pool to either rise or drop, and hydrogen serving as the filler gas. Further developments include one- or two-directional switches with delay action produced by choking of the mercury, and rotating magnetically controlled multicontact switches with mercury films wetting the contact surfaces as well as serving as a bearing for the motor-driven electrode at the center. Mercury contactors can operate under mechanical perturbations with accelerations above 50 g, an amalgam layer on the contact surface preventing contact jitter. Figures 4; tables 2.
[124-2415]

USSR

ELECTROLYTIC ALUMINUM CAPACITORS

Moscow RADIO in Russian No 11, 1979 pp 57-60

NEZNAYKO, A.

[Abstract] This section of the magazine, intended to be cut out and inserted in a notebook, presents tables showing the nominal voltage, nominal capacitance, dimensions and mass of various electrolytic capacitors. Drawings illustrate the shape and dimensions of the condensors. Figures 5; Tables 11.
[106-6508]

USSR

TECHNOLOGICAL COUNSEL

Moscow RADIO in Russian No 11, 1979 p 61

USTINOV, I., Alma-Ata, D'YAKONOV, V., Smolensk, YAS'KOV, A., Makhachkala, and BOZHENKO, YE., Volzhskiy, Volgorodskiy Oblast

[Abstract] Tips for electronics buffs are presented. A two part plastic shaper is described which bends the leads on standard microcircuits to the proper direction and shape for insertion into printed circuit board sockets. A microcircuit socket is described, to be soldered to the printed circuit board before the microcircuit is plugged in, avoiding the danger of damaging the microcircuit with the heat of the soldering iron. Two additional simple socket designs are also presented. Figures 4.
[106-6508]

USSR UDC [621.335:625.2.012.858:538.65]:621.313.13-12

PROBLEMS AND PROSPECTS FOR CREATION OF HIGH-SPEED OVERLAND TRANSPORT

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 11, Nov 79 pp 959-969
manuscript received 5 Apr 79

BOCHAROV, VASILIY IVANOVICH, candidate in technical sciences, Senior Scientific Research Worker, Assistant to the Director, VELNII (?All-Union Scientific-Research Institute of Electric Locomotive Construction); VASYUKOV, OLEG ALEKSANDROVICH, engineer, VELNII; VORONOV, NIKOLAY ALEKSANDROVICH, candidate in technical sciences, Head of a Department, VELNII: DUBOV, VASILIY VASIL'YEVICH, candidate in technical sciences, Head of a Laboratory, VELNII; KOZOREZOV, MIKHAIL ALEKSANDROVICH, head of a department team, VELNII; KOMARETS, ALEKSANDR IVANOVICH, assistant head of department, VELNII; KUPRIANOV, YURIY VLADIMIROVICH, candidate in technical sciences, Senior Scientific Research Worker, Head of a Laboratory, VELNII; NOVOGRENKO, NIKOLAY MATVEYEVICH, candidate in technical sciences, Head of a Department, VELNII; and PAVLYUKOV, VALERIY MIKHAYLOVICH, chief designer of a department, VELNII

[Abstract] This paper is part of a special number of ELEKTROMEKHANIKA devoted to the subject of High-Speed Overland Transport (VSNT). An analysis is made of work on VSNT in the Federal Republic of Germany, the U.S., Japan and the USSR. The results are presented of work in the USSR during 1975-1978. Problems and the prospects for creation of 1) Domestic VSNT with electromagnetic suspension (EMP) and linear induction motors (LAD); and 2) Domestic VSNT with electrodynamic suspension (EDP) and linear synchronous motors are discussed. The basic parameters considered for the rolling stock of VSNT with EMP and LAD are listed in a table. It is concluded that work on VSNT with EMP and LAD should proceed with some lead relative to VSNT systems. For a thorough experimental evaluation of VSNT systems with EMP and LAD, conducting experimental design operations and scientific-research work, it is necessary to subordinate the construction up to 1985 of a separate prototype (maketnyy) specimen of a vehicle with parameters in accordance with the above-mentioned table and an experimental proving ground with an extent of 10--15 km. Creation of test specimens of a vehicle with EDP as well as proving ground suitable for them is postponed to 1990. Tables 1; references 12: 7 Russian, 5 Western.
[119-6415]

USSR UDC 538.122

MOVEMENT OF THIN CONDUCTORS OF COMPLEX PROFILE IN A MAGNETIC FIELD I.

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 11, Nov 79 pp 970-982
manuscript received 15 Jun 78

ASTAKHOV, VLADIMIR IVANOVICH, candidate in physico-mathematical sciences, Assistant Professor, Novocherkassk Polytechnical Institute

[Abstract] This paper is part of a special number of ELEKTROMEKHANIKA devoted to the subject of High-Speed Overland Transport (VSNT). A method developed in previous works by Astakhov is generalized for calculation of the pondermotive interaction of a moving conductor with the magnetic field of specified sources, as applied to conductors of complex profile. The classification of profiles, the boundary value problem for eddy currents, disconnected and closed profiles, and the force acting on the conductor are discussed. The results of this paper can be used in the design of electrodynamic suspension devices of high-speed transport with track structures of complex profile. Examples of the numerical realization of the mathematical model formulated with be published in subsequent numbers of ELEKTROMEKHANIKA as well as in the Inter-VUZ collection "High-Speed Overland Transport," prepared for publication in 1979 by the Editorial-Publishing Department of Novocherkassk Polytechnical Institute. Figures 3; references: 3 Russian.
[119-6415]

USSR UDC [621.335:625.2.012.858:538.65]:621.313.13-12

CONCERNING VERTICAL OSCILLATIONS IN A SYSTEM OF ELECTRODYNAMIC SUSPENSION OF A VEHICLE FOR HIGH-SPEED OVERLAND TRANSPORT

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 11, Nov 79, pp 983-990 manuscript received 4 Jun 79

BAYKO, ANDREY VALER'YANOVICH, engineer, Leningrad Institute of Railroad Transport Engineers and VOYEVODSKIY, KONSTANTIN EMMANUILOVICH, senior engineer, Leningrad Institute of Railroad Transport Engineers

[Abstract] This paper is part of a special number of ELEKTROMEKHANIKA devoted to the subject of High-Speed Overland Transport (VSNT). As its title indicates the paper is concerned in general with electrodynamic suspension of vehicles (ekipazh) for VSNT which are based on the phenomena of electrodynamic levitation, i.e., on the interaction of a conducting track bed (putovoye polotno) with current coils moving close to it. In particular, the work studies the small natural vertical oscillations of a vehicle

for VSNT, moving over an indefinitely wide road bed of a finite thickness with constancy of the horizontal component of the speed of movement assumed. The most important characteristics of these oscillations are the angular frequency ω and the damping coefficient β. Exposure of the dependences of these magnitudes on the principal parameters of the problem is the basic goal of the work. The connection between the mechanical oscillations of the vehicle and the oscillations of the current intensity in the vehicle circuit caused by them is also investigated. Calculations are made of the oscillatory characteristics in a wide range of system parameters. All of the calculations assume that the vehicle profile has the form of a rectangle 1.5 m long and 0.5 wide and the track bed is produced from aluminum with a restivity of $3.2\cdot10^{-8}$ ohm.m. Figures 6; references 7: 5 Russian, 2 Western.
[119-6415]

USSR UDC [621.335:625.2.012.858:538.65]:621.313.13-12

ANALYSIS OF THE CONFORMITY OF LEVITATION PARAMETERS OF ROTATING AND LINEAR MODELS OF ELECTRODYNAMIC SUSPENSIONS

Novocherkassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 11, Nov 79 pp 991-998

KOCHETKOV, VALERIY MIKHAYLOVICH, candidate in physicomathematical sciences, Senior Scientific Research Worker, Leningrad Institute of Railroad Transport Engineers; MAKAROV, YEVGENIY FEDOROVICH, Senior Scientific Research Worker of the All-Union Scientific Research and Planning-Design Institute VNIIPITransprogress, Moscow; CHEREVATYY, ALEKSANDR VIKTOROVICH, senior engineer, VNIIPITransprogress, Moscow; and BAYKOV, VLADIMIR VASIL'YEVICH, Junior research worker, Leningrad Institute of Railroad Transport Engineers

[Abstract] This paper is part of a special number of ELEKTROMEKHANIKA devoted to the subject of High-Speed Overland Transport (VSNT). During an investigation of systems of electrodynamic suspension of VSNT, model units containing rotating drums are widely used for experimental measurement of the forces of levitation and braking. Forces are studied which act on the current element on the rotating drum, and the current elements on the flat road bed. The data obtained show that a very significant error in the measurement of the forces is caused by the curvature of the drum's surface and considerable care is required during extrapolation of the experimental results obtained during model measurements to the real operating conditions of systems of electrodynamic suspension. The authors thank A. V. Bayko for conducting computer calculations with respect to their work. Figures 6; references 8: 4 Russian, 4 Western.
[119-6415]

USSR UDC 621.335.2:621.318.3.001.24

CONSIDERATION OF VARIABILITY OF A GAP CAUSED BY ROTATION OF ELECTROMAGNETS DURING CALCULATION OF SYSTEMS OF MAGNETIC SUSPENSION

Novocherbassk IZV.VUZ:ELEKTROMEKHANIKA in Russian No 11, Nov 79
pp 1010-1013 manuscript received 5 Apr 78; after completion 13 Jul 79

BUROK, VALERIY STANISLOVOVICH, candidate in technical sciences, Assistant Professor Novocherkassk Polytechnical Institute; and VESELOVSKAYA, LYUDMILA PAVLOVNA, assistant, Novocherkassk Polytechnical Institute

[Abstract] This paper is part of a special number of ELEKTROTEKHNIKA devoted to the subject of High-Speed Overland Transport (VSNT). During movement of a vehicle (ekipazh), in connection with the formation of an inclination of an electromagnet with respect to the rail, the tractive force of the magnet and the coordinates of the point of its application change, and this circumstance can affect the dynamics of the vehicle and in particular the operation of the suspension elements of the same electromagnet. For this reason an attempt is made to evaluate the order of magnitude of these changes and the possible limitations which may arise during working out the design of the suspension elements. The magnitudes obtained are approximate and final conclusions can be made after calculation of forces by precise methods or the basis of more complete experimental tests. Figures 4; references: 2 Russian.
[119-6415]

USSR

MORE RELIABLE OPERATION OF A ZBU-12/10 BUFFER CHARGING DEVICE

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 1, Jan 80 pp 33-34

YESYUNIN, V. I., chief, Laboratory of Automation, Telemechanics and Communications Gorkiy Railroad

[Abstract] A buffer charger of the ZBU-12/10 type, including a bridge comparator circuit and two relays, is now connected to a storage battery through a 2-conductor line. It has been found to operate with insufficient stability at high charging currents, because of voltate fluctuations at the rectifier output. For eliminating this deficiency, a 4-conductor connection is proposed and insertion of a 2000 μF - 25 V capacitor across two adjustable voltage regulating resistors at the stabilizer output. The entire circuitry has also been laid out for better checking and tuning. Figures 2.
[124-2415]

USSR

TAPE RECORDER FROM OFF-THE-SHELF

Moscow RADIO in Russian No 12, 1979 pp 35-37

ZYKOV, N., Moscow

[Abstract] It is demonstrated that it is possible to assemble a stereophonic tape recorder of practically any structure from functional units described in previous articles in this journal. It is possible to use as a foundation the tape transport of any monophonic tape recorder or tape deck, because of the not too great size of the units and the possibility of remotely switching predistortion and response correction circuits. In the majority of cases it is possible to utilize the controls already in a tape recorder. Few additional components are necessary and several optional components can be added to broaden the range of operating capabilities. A circuit diagram is given for a very simple piece of equipment made of off-the-shelf units--a tape playback deck. It consists essentially only of a playback amplifier to whose input a block of playback heads is connected and to whose output a socket. Also given is the circuit diagram of a tape deck with separate record and playback amplifiers and a universal magnetic head. This deck can be adapted for recording and playing back monophonic programs. This deck requires a stabilized power supply. Particular attention is devoted to the circuitry of a stereophonic tape deck with a built-out channel, demonstrated at the 29th Work Exhibition of DOSAAF [All-Union Voluntary Society for Assistance to the USSR Army, Air Force and Navy] Radio Amateurs and Designers. The foundation of this deck is the tape transport of the "Yauza-212" four-track monophonic tape recorder. The redesign work consisted in replacing the fitting on the shaft of the motor to produce a speed of 19.05 cm/s, installing a second pointer indicator and one more variable resistor as a record level control, and replacing the record and playback heads with improved unified heads from the "Rostov-102-Stereo" tape recorder. The deck's playback channel consists of a block of playback heads, a playback amplifier, a block of filters, switches and an output socket. A relay makes it possible to block the output of the playback amplifier when the tape transport is stopped and when the tape is being rewound. This deck features a comparison check, i.e., the comparison of the signal being recorded and of the one already recorded, both by listening and by reading pointer-type level indicators. This is convenient from the viewpoint of making it possible in the recording process to judge objectively the quality of a recording and to eliminate possible flaws in time. The circuit shown does not feature a microphone input, but this can easily be provided by adding a microphone amplifier and one more switch button. This deck has several automatic features: The tape transport is stopped at the end of a tape or when a tape breaks, as well as when the mains voltage drops and the record button is accidentally pressed in the playback mode. The transport cannot be turned on an rewinding is impossible with incorrect threading of the tape and when the program source is not

switched on in the record mode. A temporary stop position is provided. The deck can be powered by a somewhat redesigned "Yauza-212" stabilized rectifier. For this purpose the polarity of the diodes, stabilitrons and electrolytic capacitors is reversed and the P213A transistor is replaced with a KT805A silicon transistor. Figures 4.
[108-8831]

USSR

ELECTRONIC MUSIC SYNTHESIZERS

Moscow RADIO in Russian No 10, 1979 pp 50-53

VOLODIN, A., Moscow

[Abstract] Doctor A. A. Volodin, a psychologist, has designed and constructed a number of music synthesizers. In response to many letters to the editor, the journal begins with this issue the publication of a series of articles describing the design and operation of music synthesizers. This first article contains a brief historic review of the development of electronic music synthesis and the description of its current state. It is intended to serve as an introduction to the series of articles on synthesizer design. A distinction is made between electronic musical instruments and music synthesizers, which generally are designed to produce a much broader range of sounds, not attempting to imitate traditional music instruments. Figures 4.
[83-6508]

USSR UDC 533.9.01

PASSAGE OF ELECTRON-PLASMA WAVES THROUGH A LAYER OF MAGNETIZED PLASMA

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79 pp 2152-2154 manuscript received 7 Mar 78

SKOVORODA, A. A. and SHVILKIN, B. N.

[Abstract] Data are presented pertaining to passage of waves through a plasma with a steep density jump in the direction of the magnetizing field. The experiment was performed with an argon plasma inside a cylindrical glass tube and in a uniform magnetic field. Nonhomogeneity of the plasma was achieved by means of three hollow molybdenum cylinders asymmetrically spaced along the tube axis, all having the same diameter and the middle one serving as the anode for initiation of a Pitting discharge. An analysis of the electron concentration profile, the oscillation amplitude profile, and the noise amplitude profile reveals not only reflection and absorption of the electron-plasma wave but also its passage through a barrier, largely dependent on the plasma conditions before the barrier. Figures 2; references 9: 8 Russian, 1 Western.
[118-2415]

USSR UDC 537.86

CONCERNING THE PARTICULARS OF REFLECTION AND REFRACTION OF A PLANE ELECTROMAGNETIC WAVE IN A THIN NONLINEAR DIELECTRIC LAYER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 78-84 manuscript received 4 Nov 78

BAGDASARYAN, O. V. and PERMYAKOV, V. A.

[Abstract] Effects of hysteresis reflection and refraction of plane monochromatic H- and E-waves are considered for the case of a thin layer of a nonabsorbing, nonlinear dielectric $(0 \leq z \leq l, -\infty < x < +\infty, -\infty < y < +\infty)$ over a wide range of angles of wave incidence. Self-stressing of the waves is considered for a dielectric layer with cubic nonlinearity. The physical reason for hysteresis is the rapid reduction in the reflectivity and hence an increase in the internal field with increasing amplitude of the incident field for a material with ionization nonlinearity. The results of this research may be useful in developing nonlinear optical and microwave devices. Realization of hysteresis effects under conditions of low-temperature breakdown of semiconductors offers additional possibilities for optimizing

characteristics of these devices such as switching time, threshold power and so forth. Figures 4; references 16: 15 Russian, 1 Western.
[123-6610]

USSR UDC 537.867

SCATTERING OF ELECTROMAGNETIC WAVES IN NONHOMOGENEOUS DIELECTRIC MEDIA WITH AN AXISYMMETRIC AND CYLINDRICAL GEOMETRY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 1996-2006 manuscript received 11 Jul 78

SAFONOV, I. B.

[Abstract] Scattering of electromagnetic waves in a dielectric medium with the refractive index $N = \sqrt{1- [f(\theta)/R]^m}$ $(m > 0)$ is considered, for any arbitrary differentiable function $f(0)$ of the angular coordinate, for any angle of incidence, and for any dimensions of the medium characterized by the limiting concentration of free electrons. Calculations are made first for the special case $N = \sqrt{1- f^2/R^2}$, where the variables can be separated, and then for the general case. Here application of the Fermi principle and reduction to a hypergeometric equation yield expressions for the back-scattering diameter and the effective radius of curvature in the geometrical-optics approximation. Figures 6; references: 7 Russian.
[118-2415]

USSR UDC 551.510.535

SPECTRUM OF LARGE-SCALE ARTIFICIAL INHOMOGENEITIES IN THE F-LAYER OF THE IONOSPHERE

Gor'kiy IZV.VUZ:RADIOFIZIKA in Russian Vol 22 No 10, 1979 pp 1278-1281
manuscript received 27 Mar 79

YERUKHIMOV, L. M., KOVALEV, V. I., LERNER, A. M., MYASNIKOV, YE. N., PODDEL'SKIY, I. N. and RAKHLIN, A. V., Scientific Research Radio Physics Institute

[Abstract] The results are given of measurements, made by the method of probing the ionosphere with signals from orbiting satellites, of artificial inhomogeneities created by high-power shortwave radio-frequency radiation. In an earlier study measurements were made of the spectrum of fluctuations in the signal of a geostationary satellite when probing in different altitudes of the region occupied by artifical inhomogeneities; in this experiment signal fluctuations were observed, caused by the movement of inhomogeneities in the east-west direction. A characteristic feature of these spectra when probing the turbulent region near the altitude of reflection of high-power radio waves is the presence of a maximum on the $F_A(X_x)$ curve in the scale range of ℓ_x = 500 to 600 m, where F_A represents amplitude fluctuations and X_x represents the wave number along the x-axis, in this case, the east-west direction. This feature testifies to instability effectively giving rise to inhomogeneities of these scales. Autofocusing instability is a likely cause. In another study the problem was considered of a plane radio wave striking a layer of the ionosphere vertically, in which it was demonstrated that the linear stage of instability can result in the formation of inhomogeneities extended in the plane of a geomagnetic meridian. The reason for this is that the most effective subdividing of the plasma in this case takes place along a line orthogonal to the plane formed by the wave vectors of the radio wave and the magnetic field. A measurement was made of the spectrum of fluctuations in signals of a satellite which crossed the perturbed region in the north-south direction, for the purpose of verifying this model. The ionosphere was excited by a high-power shortwave radio transmitter located near Gor'kiy and signals at a frequency of 150 MHz from American NNS polar satellites were received at an observation station in Smolensk. By utilizing different satellite trips, it was possible to probe different altitude ranges of the perturbed region. Curves are shown of values of the scintillation index for satellite signals measured at different altitudes over the range of bearings in relation to the perturbed region. It can be seen that at two altitudes there is a fairly distinct region bounded on the south and north and having horizontal dimensions of approximately 100 km, occupied by artificial inhomogeneities. At high altitudes the signal fluctuation spectrum in probing the perturbed region is similar to the spectrum of natural scintillation. These results agree with earlier measurements of spectra at high altitudes and lead to the conclusion that the influence of high-power radio-frequency radiation can result in the "intensification" of natural ionospheric inhomogeneities over a fairly broad altitude range. Measurements of the spectra of scintillation in two mutually perpendicular directions of north-south and east-west have made it possible to conclude that the spectral intensity of artificial inhomogeneities is isotropic in the plane perpendicular to the direction of the magnetic field. Figures 3; references: 2 Russian.
[93-8831]

USSR UDC 621.371.25

SCATTERING OF WHISTLER MODES IN IONOSPHERIC INHOMOGENEITIES EXTENDING ALONG THE GEOMAGNETIC FIELD

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 10, 1979 pp 1195-1204
manuscript received 6 Oct 78

BELENOV, A. F. and CHUGUNOV, YU. V., Scientific Research Radio Physics Institute

[Abstract] The problem is discussed of the excitation in ionospheric waveguides of whistler modes, with special attention devoted to the excitation of a waveguide as the result of scattering in inhomogeneities extended along the geomagnetic field. An ionospheric waveguide containing inhomogeneities is represented as consisting of homogeneous and inhomogeneous sections. The homogeneous section of the waveguide is modeled as a cylindrical void with a dielectric constant, ε, equal to one with $r < R_1$ and $\varepsilon = \varepsilon_1 < 1$ with $r \geq R_1$, where r is the distance to the observation point in a cylindrical system of coordinates with the origin at the center of Earth. The parameters of the waveguide, such as the volume of the waveguide channel, the number of modes in the channel and the volume occupied by an individual mode depend on the choice of the values of R_1 and ε_1. It is possible to select values of ε_1 and R_1 such that these parameters of a waveguide model of this sort will be close to the like parameters of a real above-ground waveguide. Parameters are selected which satisfactorily describe in this model the propagation of radio waves in the plane of a great circle; for the frequency band of $\omega \simeq (1.5 \text{ to } 2) \cdot 10^8$ Hz, $\varepsilon_1 = 0.92$ and $z_1 = 90$ km in the daytime, where $z_1 = R_1 - R_0$ and R_0 is the radius of Earth and $\varepsilon_1 = 0.92$ and $z_1 = 100$ km at night. The inhomogeneous section of the waveguide is represented as an axisymmetric perturbation of the dielectric constant, i.e., $\varepsilon_n = 1 - \Delta\varepsilon(x,z)$, whereby the Cartesian system of coordinates x,z is arranged so that the axis of symmetry of the inhomogeneity is in line with the z-axis. The excitation of an ionospheric waveguide is discussed, resulting from the scattering of an incident electromagnetic wave with the peak value of the electric field in the inhomogeneity, $\Delta\varepsilon(x,z)$. The scattered field is represented in the form of the superposition of normal modes of the waveguide. The case is discussed when the incident wave is one of the normal modes of an ionospheric waveguide. Here it is shown that scattering takes place into modes strongly different from the incident and similarities are found to the "angular" scattering of a plane wave in a vacuum in extended inhomogeneities. An estimate is made of the percentage of scattered energy for the case of the incidence of a glancing wave onto an inhomogeneity with emphasis on the share of the energy let out of the waveguide channel and striking the surface of Earth. In direct scattering in a homogeneity extended along the magnetic field, a waveguide mode is transformed into modes close to the

incident mode. In backscattering, excited most effectively are modes satisfying a condition representing the waveguide analog of the conditions for geometrical foreshortening. Also discussed is the excitation of an ionospheric waveguide by a radio signal emitted from the surface of Earth. An analysis is made of the degree of excitation of an ionospheric waveguide as a function of the number of the mode with attention paid to the dependence of the excitation coefficient on the angle of incidence of a plane wave onto an inhomogeneity with the inhomogeneity not completely spanning the volume of the wave channel. It is found that for the purpose of exciting individual types of waveguide modes, i.e., for the purpose of mode selection, it is necessary that the regions of angles corresponding to different numbers of waveguide modes do not overlap. Figures 3; references 10: 9 Russian, 1 Western.
[93-8831]

USSR UDC 621.371.332.1

RECONSTRUCTION OF THE WAVE FRONT OF RADIO SIGNALS IN THE IONOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 72-77 manuscript received 11 Jul 78

GUSEV, V. D. and KUNITSYN, V. YE.

[Abstract] Experimental verification of the theory of scattering of radio waves in the ionosphere by the characteristics of scattered waves necessitates representation of the field at the output from the ionosphere from the results of ground-based measurements. The authors consider this analog of holography and derive expressions for the errors of wave front reconstruction caused by limitation of the field of measurements, the discreteness of the measurements and imprecision in determination of altitudes. The size of the region of measurements and the approximate number of receivers can be determined from the necessary accuracy of reconstruction and the error of altitude determination. Figures 4; references: 4 Russian.
[123-6610]

USSR UDC 621.371.334

RADIATION FROM A POINT CHARGE MOVING AT A CONSTANT VELOCITY ALONG THE AXIS OF A CIRCULAR HOLE IN A PLANE SCREEN

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2136-2139 manuscript received 27 Mar 78

PAZYNIN, L. A. and SOLOGUB, V. G.

[Abstract] Diffraction radiation from a point source moving at a constant velocity along the axis of a circular hole in an infinitely large plane ideally conducting screen is analyzed in a cylindrical system of coordinates with the origin at the center of the hole. The current is assumed to be given and the problem is reduced to a pair of Fredholm integral equations of the second kind. The solution yields the spectral characteristic of the radiation power over the entire frequency range, including longwave and shortwave asymptotes, as well as the time dependence of the radiation energy. A comparison with the Kirchhoff approximation indicates that for a charge moving at a velocity near the velocity of light this approximation is quite accurate at low and high frequencies. At nonrelativistic velocities the correction to this approximation is of the same order of magnitude as the latter. Figures 2; references: 5 Russian.
[118-7415]

USSR UDC 621.385.6.001.24

MOTION OF A MONOENERGETIC ELECTRON BEAM IN THE FIELD OF A NONMONOCHROMATIC WAVE OF FINITE AMPLITUDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2062-2068 manuscript received 19 Jul 78

GRISHAYEV, V. I., DEMCHENKO, V. V. and OMEL'CHENKO, A. YA.

[Abstract] A nonrelativistic monoenergetic electron beam in the electric field of a nonmonochromatic potential wave is considered under conditions of Cerenkov resonance. The wave has a finite amplitude and the beam has a uniform cross-sectional distribution of electron equilibrium density, its electrons moving at a constant velocity relative to quiescent ions. The problem of excitation of longitudinal oscillations in the beam by the electric field of an extraneous source is solved on the basis of the highly nonlinear second-order differential equation for the Lagrange electron displacement, assuming the electric field to be a superposition of two waves traveling with different phase velocities, and disregarding any

thermal motion. The solution yields elliptical trajectories in the phase plane characterizing the periodic motion of electrons trapped by the field, with straight separatrices between them as long as the displacement of electrons relative to the quiescent trajectories remains much smaller than the wavelength. The eccentricity of these ellipses increases with larger amplitudes of the initial electron oscillations in the beam. The authors thank A. B. KITSENKO, V. I. KURILKO and K. N. STEPANOV for the helpful discussion of the results. Figures 1; references 8: 7 Russian, 1 Western.
[118-2415]

USSR UDC 621.385.6.029.65.001.24

THEORY OF PARAMETRIC STEP-UP FREQUENCY CONVERSION IN ELECTRON BEAMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2084-2088 manuscript received 5 Dec 77

KALMYKOV, A. M., KOTSARENKO, N. YA. and KULISH, V. V.

[Abstract] Interaction of transverse electromagnetic waves with rectilinear electron beams can result in a step-down or a step-up frequency conversion and, in the latter case, in an increase of electromagnetic power. Here stepup frequency conversion is considered with a retarded electromagnetic wave, which does not require high-current relativistic electron beams and is more efficient than with a nonretarded one. First a linear theory is constructed to describe the interaction, then the complete range of nonlinear conversion from an electromagnetic wave of low frequency to one of high frequency is established and the optimum length of the interaction space as well as the efficiency of such a conversion are determined. Calculations indicate that a frequency step-up of $5\cdot10^2-10^3$ is feasible with weakly relativistic electron beams generated by conventional electron guns. References 4: 2 Russian, 2 Western.
[118-2415]

USSR

PREDICTION OF RADIO WAVE PROPAGATION

Moscow RADIO in Russian No 10, 1979 pp 18-19

LYAPIN, G., UA3AOW, ex UA9OW

[Abstract] Beginning with this issue, the monthly prediction of radio wave propagation conditions for the 14-28 MHz amateur radio band is expanded to include propagation forecasts for 6 different points instead of 2, with a total of 33 different radio links. In addition to Moscow and Irkutsk, which were previously reported, propagation conditions are forecast for areas with their centers at Leningrad, Stavropol', Novosibirsk and Khabarovsk. Several characteristic long distance links passing over the pole and through the auroral zone, and also through the middle latitudes and across the equator, are included in the prediction. Figures 1; tables 1. [863-6508]

USSR UDC 537.533.3

ON ESTIMATING THE CONTRIBUTIONS OF ABERRATIONS TO THE SIZE OF AN ELECTRON PROBE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 218-220 manuscript received 24 Apr 78

EDEL'SHTEYN, G. B. and MAKAROV, K. A.

[Abstract] In developing electron-probe devices such as scanning electron microscopes and x-ray microanalyzers, it is necessary to evaluate the size of the electron probe. In this paper the authors propose a method of determining electron probe size based on determining the resultant current density with convolution of independent distributions corresponding to the image of the crossover, diffraction washout, and spherical and chromatic aberrations. It is shown that the proposed approach to evaluation of different contributions to beam blurring gives less weight to diffraction and spherical aberration and more weight to chromatic aberration than in the less rigorous conventional method. References 7: 3 Russian, 4 Western.
[123-6610]

USSR UDC 537.533:537.528

THE PART PLAYED BY PHASE EXPLOSION OF METALS IN THE PROCESS OF EXPLOSIVE ELECTRON EMISSION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 157-167 manuscript received 14 Apr 77

MARTYNYUK, M. M.

[Abstract] Previous research with exploding wires has shown that when the current density is high, most of the molten metal is heated above the boiling point right up to the vicinity of the spinodal point where the dissociation of the metastable liquid phase is determined by the intense process of homogeneous formation of vapor nuclei, termed phase explosion. If the heating rate is such that the process of homogeneous nucleation is steady, the explosive transition of molten metal to vapor is determined chiefly by this process (steady-state phase explosion). Increasing the heating rate disrupts the steady state of nucleation, and thermodynamically unstable states of the molten metal are realized. The explosive transition is then determined by the kinetics of dissociation of these unstable states (unsteady phase explosion). In a previous paper by this author ("Zhurnal tekhnicheskoy fiziki," Vol 48, No 7, 1977 p 1482) it was concluded that the increase of initial emission current in explosive electron emission is

caused by a sharp jump in thermal emission intensified by the Schottky effect and by penetration of the electric field into the exploding point material as a consequence of metal-to-nonmetal transition with approach to the spinodal point. On the next stage the current is intensified by an increase in the emitting surface with explosive formation of finely dispersed vapor-liquid mixture. In this paper the author pursues this concept further, investigating the influence that the kinetics of the liquid-to-vapor phase transition has on the conversion of electron field emission to explosive emission in electric explosion of a metal point. An examination is made of the phase diagram of the metal in the vicinity of this transition. An expression is found for the density of the heating current that results in steady-state phase explosion. The specific thermal emission of metals in the vicinity of the spinodal point is calculated. It is shown that in this region electron field emission gives way to explosive emission. The nature of explosive emission from a point cathode is determined by the abrupt intensification of thermal emission, and also by the increase in the emitting surface due to formation of the finely dispersed liquid-vapor mixture. The transition to the semiconductor state near the spinodal point and the influence of the Schottky effect become important for low-melting metals. An analysis is made of the influence that the kinetics of unsteady phase explosion has on the explosive electron emission of metals. Figures 1; references 17: 16 Russian, 1 Western.
[123-6610]

USSR UDC 621.385.6

AMPLIFICATION OF AMPLITUDE-MODULATED MICROWAVE SIGNALS IN AN O-TYPE TRAVELING-WAVE TUBE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79 pp 2159-2161 manuscript received 2 Jan 78

ZHELEZOVSKIY, B. YE. and KLINAYEV, YU. V.

[Abstract] Under consideration is a signal passing through an O-type traveling-wave tube, after its amplitude has been modulated at the tube entrance by a harmonically varying high-frequency signal. The amplification process here is analyzed by resolving the carrier signal into harmonic components with amplitudes and phases to be determined from the system of nonlinear multifrequency equations of such a tube. The signal spectrum includes harmonic and combination frequencies, all multiples of some fundamental one. The evolution of the signal waveform with time along the interaction space, calculated for one fundamental period, reveals parasitic amplitude-phase modulation during strong amplification even before field-free drift of electrons occurs. Figures 2; references: 1 Russian.
[118-2415]

USSR UDC 621.385.632

CONSTRUCTION OF AN ENGINEERING THEORY OF THE O-TYPE TRAVELING-WAVE TUBE BASED ON POLYNOMIAL MODELS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80 pp 140-149 manuscript received 15 Jun 78

ZHELEZOVSKIY, B. YE. and KOZYREV, A. P.

[Abstract] It is shown that a number of the principal modes of operation of the O-type traveling-wave tube can be described on the basis of simple interpolation models constructed with the use of methods of the theory of experiment planning and multidimensional approximation. This approach not only reveals new and important problems that are associated in particular with optimizing working conditions within given limits of variation of the parameters of the device. Simple analytical relations between the output characteristics and input parameters of the tube and its working conditions are derived on the basis of first-order and second-order polynomials. Figures 5; references: 10 Russian.
[123-6610]

USSR

GENERAL PLAN FOR LENINGRAD'S HEAT SUPPLY SYSTEM FOR THE PERIOD TO 1990

Moscow ENERGETIK in Russian No 11, 1979 pp 35-36

[Abstract] A review by the USSR Ministry of Power and Electrification Scientific and Technical Council is given of the general plan for Leningrad's heat supply system developed by the northwest division of VNIPIenergoprom [All-Union Scientific Research and Planning Institute of the Power Engineering Industry]. The city of more than 4 million people now receives its heat from 7 heat and electric power plants (TETs's) of the Lenenergo Rayon Energy Administration, 4 industrial TETs's, 34 rayon boiler houses, 520 industrial boiler houses and 1850 small boiler houses for the housing and municipal sector. The installed heat capacity of all sources of heat on 1 Jan 1976 was 21,300 Gcal/h. The installed electric power capacity of all Tets's in Leningrad on the same date was 1487 MW, and their heat capacity was 6,500 Gcal/h. Heat is supplied from TETs's to consumers through an open supply system with calculated temperatures of the direct and return water of 150 and 70°C. Consumers are hooked up to the system through a dependent system, i.e., the water arrives directly from the heating network into the heating system. The total length of water pipes leading from TETs's equals 1053 km, including 988 km of water pipes and 65 km of steam pipes. The city's total demand for heat has been estimated at 31,200 Gcal/h in 1985 and 37,600 Gcal/h in 1990. Key decisions for the future of Leningrad's heating system made by the scientific and technical council include the following: The development of the heat supply is to be based as much as possible on the combined generation of heat and electric power. Existing TETs's will be expanded. The TETs-5 will receive 3 new units of the T-180-130 type with a total capacity of 540 MW to increase its estimated heat output to 1500 Gcal/h with provision for further expansion. The TETs-15 will be given 2 new units of the T-110-130 type with a total capacity of 220 MW to increase its heat output to 360 Gcal/h, with the possible replacement of obsolete equipment. The TETs Severnaya [North] will be given 2 new units of the T-175-130 type with a total capacity of 350 MW in order to bring its heat output up to 1000 Gcal/h with provision for future expansion. The TETs Yuzhnaya [South] will be given 2 new units of the T-250/300-240 type with a total capacity of 500 MW to bring its heat output up to 1200 Gcal/h with provision for future expansion. The TETs-2 will be totally reconstructed in order to enable the elimination of about 500 small boiler houses in Smol'ninskiy Rayon. The plan is to erect during the 11th and 12th Five-Year Plan periods a new Northwest TETs to contain 5 or 6 units of the T-180/215-130 type with a rated heat output of 3000 to 3300 Gcal/h with provision for it to supply heat to peak-operation boiler houses. Shale oil which is to be produced in Estonia is to be the chief fuel for the TETs-2 and the Northwest TETs. Natural gas is to be used as the main fuel for expanded TETs's, as well as temporarily for the first phase of the TETs-2 and the Northwest TETs until the shale oil is available. The central heat supply system of Leningrad is to be oriented after 1990 toward

nuclear power. Certain technical improvements are planned, such as the construction of large control stations equipped with automatic devices and remote monitoring and control equipment to handle the heat supply of a large quarter. In the future an independent system is to be used for connecting heating systems to the heating network while keeping the open system for the hot water supply system.
[105-8831]

USSR UDC 621.316.91

WORKING ALGORITHM AND DIODE NETWORK REALIZATION OF A HIGH-SENSITIVITY DIRECTIONAL DIFFERENTIAL PROTECTION CIRCUIT

Novocherkassk IZV.VUZ: ELEKTROMEKHANIKA in Russian No 9, Sep 79
pp 806-808 manuscript received 25 Oct 77, after completion, 27 Apr 78

POLYAKOV, VALENTIN YEFIMOVICH, doctor in technical sciences, Professor, Ural Polytechnical Institute; and KLETSEL', MARK YAKOVLEVICH, senior instructor, Pavlodar Industrial Institute

[Abstract] The activating current for a differential transverse current protector on parallel lines is tuned away from the maximum current of imbalance in the case of external short circuits, maximum working current flowing through both lines, and maximum current in undamaged phases in the case of cascaded outages. In power grids with isolated neutrals, the sensitivity of the protector to two-phase short circuits can be increased by special implementation of a circuit in which the necessity for detuning is obviated for the last two conditions because protection is taken out when one of the working lines is disconnected from the opposite side, and also at the instant of activation of one line from the given end when the other line is working, and because disconnection of an undamaged line is prevented when protection may be activated due to transmission of heavy currents in the undamaged phase with two-phase short-circuiting on the other line. A working algorithm of the logic section of the circuit is proposed, based on analysis of the behavior of measuring instruments under various conditions. Figures 1; references: 5 Russian.

[80-6610]

USSR UDC 538.08

METHOD OF MEASUREMENT OF ANGULAR SPEED NONUNIFORMITY USING MAGNETIC RESONANCE

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79 pp 36-41 manuscript received 5 Dec 78

DUDCHENKO, A. K., KUTS, P. S., MAR'YENKO, V. V. and SKOBLYA, YU. A.

[Abstract] The method described in this paper and an instrument achieving it are intended for measurement of angular speed nonuniformity. The principles of operation prescribed in the basic method consists in conversion of the change of the speed of rotation to a change of the magnitude of the magnetic field, which can be measured with high precision by the magnetic resonance method. For this purpose eddy currents are used which originate as the result of rotation of a nonmagnetic disk in a nonuniform magnetic field. The magnetic field induces by these currents is proportional to the speed of rotation of the disk. By measuring this field it is possible to obtain information concerning the nature of the rotation. Use of the method described can be especially promising for investigation of the rotation of objects, which permits the creation of significant braking torques, by virtue of the fact that highly precise measurements can be made at any speed, including the lowest. In addition the small measurement time is an advantage. This makes it possible to obtain information concerning irregularities of rotation in the course of one revolution. The paper was recommended by the Kiev State University imeni T. G. Shevchenko. Figures 5; references: 4 Russian.
[120-6415]

USSR UDC 621.317

REDUCTION OF ERRORS IN DIGITAL TIME INTERVAL INDICATORS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79, pp 8-13 manuscript received 12 Dec 78

SUP'YAN, V. YA. and POKHILYUK, A. P.

[Abstract] In digital devices a variable magnetude is often converted into the time interval T_x, which subsequently is converted with the aid of a quantizing unit into digital code. Because in the general case T_x is not a multiple period of the quantizing pulses, an error of the discrete conversion of the time interval into code appears. The conversion error is decreased with an increase of the frequency of the quantizing pulses.

However, the maximum value of this frequency is determined by the speed of response of the elements of the digital units. The problem arises of increasing the precision of digital measurements of time intervals with limitation of the value of the frequency of the quantizing pulses. The possibility is shown in the present paper of decreasing this conversion error by using multichannel pulse time conversion. Algorithms for optimum construction of a multichannel converter are presented and the errors of such a converter are considered. The paper was recommended by the Department (Kafedra) of the Theoretical Basis of Radio Engineering, Vinnitskiy Polytechnical Institute. Figures 4; references: 3 Russian.
[120-6415]

USSR UDC 621.317.73

AN INSTRUMENT FOR AUTOMATIC MEASUREMENT OF THE HARMONICS OF AN ELECTROMAGNETIC TRANSDUCER

PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1979 pp 31-32

STASYUK, V. V., engineer

[Abstract] The operating principle of the instrument described in this article is based on: 1) Simultaneous separation of the active and reactive components of the measured output signal harmonic in the selection and compensation channels by expansion into a Fourier series; 2) Measurement of the separated values by comparison with standard voltages; and 3) Subtraction of the results of measurement for the standard values to produce output information in the form of the difference of the actual instantaneous values and the standard value of the measured parameter. A block diagram of the instrument is presented, as well as the basic technical characteristics: frequency range 20-1000 Hz, number of harmonics 1, 3, 5, permissible value of harmonic coefficient in reference voltage 0.05 percent, relative error in measurement of synphase and quadrature components of the harmonic not over 0.5 percent. The device can be used for processing of eddy current transducers in various areas of nondestructive testing of metal products. Figures 1; references: 3 Russian.
[75-6508]

USSR UDC 621.317.76

HIGH-SPEED TRACKING DIGITAL FREQUENCY METER-PHASE METER

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79
pp 13-16 manuscript received, 8 Aug 78

MEL'NIKOV, A. A., SMAGIN, YU. A. and TRIFONOV, YE. F.

[Abstract] During measurement of the output signals of primary converters with frequency or phase presentation of information, as well as during investigation of systems of automatic regulation, the problem arises of simultaneous measurement in the tracking mode of the instantaneous value of the frequency of the signal in question and its phase shift. Solution of this problem has been accomplished by separate use of two instruments--a tracking frequency meter and phase meter. The present paper includes a description of the device, and the results of an analysis of the speed of response and the errors of a high-speed tracking digital frequency meter--phase meter, which make it possible to unit the functions of a frequency meter and a phase meter. The paper was recommended by the Department (Kafedra) of Computing Electronic Machines, Penzensk-VTUZ (Technical Institution of Higher Education) at the Computer Electronic Machine Plant, affilitate of Penzensk Polytechnical Institute. Figures 1; references: 4 Russian.
[120-6415]

USSR UDC 621.325.58:621.335.5

SCALING OF SIGNALS

PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1979 pp 33-34

KOROVIN, N. I., engineer

[Abstract] This article presents an analysis of three signal scaling systems using variable resistors and operational amplifiers. Schematic diagrams are presented, as well as examples of the scale of scaling coefficients for the three devices. The best of the three simple devices is selected, and a circuit diagram is shown illustrating how four of these devices can be connected in series-parallel to improve sensitivity still further. Figures 3; references: 3 Russian.
[75-6508]

USSR UDC 621.374

THE INFLUENCE OF EXTERNAL RANDOM EFFECTS ON A FORK GENERATOR

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79
pp 64-69 manuscript received 4 Oct 78

DENISOV, V. I.

[Abstract] During development of the model of a generator, the fork generator of clock-type time pieces of the Chelyabinsk Time-Piece Plant was selected as an example. The principal scheme of the generator is shown and discussed. Because of the electromagnetic drive, oscillations in the generator have a pronounced nonisochronous nature and consequently a change of the mode of self-oscillations because of exterior action significantly affects the precision of the devices. A theoretical study is conducted which makes it possible for the case of Markov stationary random action to calculate the mathematical expectation and dispersion for the amplitude and frequences of auto-oscillations in fork-type clock-type time pieces. The paper was recommended by the Department (Kafedra) of Theoretical Mechanics, Moscow Technological Institute of the Food Industry. Figures 2; references: 2 Russian.
[120-6415]

USSR UDC 621.376.4

A WIDEBAND PHASE DETECTOR

PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1979 p 33

SEBKO, S. YE., engineer and SERYAKOV, YU. N., candidate in technical sciences

[Abstract] A description is presented of a circuit for a wideband phase detector, capable of detecting signals up to 35 MHz. A schematic diagram is presented of the device, which operates on the basis of comparison of the instantaneous values of a vector sum and difference of the input information signal and a reference signal. The instantaneous values are determined as the phase difference between the input signals. The phase detector consists of a phase splitter, two matching amplifiers with input capacitance compensation and two amplitude detectors with differential connection of loads. The characteristics of the device are as follows: transmission band 1 KHz-35 MHz; detection error not over ±5 percent at 1 KHz-5 MHz, not over 10 percent at 5-35 MHz. It is recommended for use in various measurement devices. Figures 1; references: 4 Russian.
[75-6508]

USSR UDC 621.382

INCREASING THE SPEED OF INTEGRATED-CIRCUIT VOLTAGE COMPARATORS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 36-42
manuscript received 10 Jul 79

ROGATKIN, YU. B.

[Abstract] Monolithic microcircuits are widely used in such devices as voltage comparators, with digital-to-analog and analog-to-digital conversion, where acquisition and processing of analog data determines the speed of the converters. High-speed voltage comparators differ basically from high-precision ones and medium-speed medium-precision ones by the absence of a differential-signal adder which converts a paraphase signal into a monophase one. Here various circuit schemes for the individual comparator stages are examined from the standpoint of attainable speed. First come input stages requiring a low bias voltage and low input currents as well as a short delay time, most expediently built with MOS field-effect transistors or controlled-junction field-effect transistors, with compensation of input currents in the input emitter-follower and pairs of resistive differential cascades in series instead of operational amplifiers. There follows the potential matching stage, which is straightforward and the performance of which depends mainly on the technology of its components, and then output stages using either emitter-followers or transistor switches with nonlinear feedback to lower the saturation rather than low-saturation transistors, which are also dynamically noisy. Figures 5; references 8: 6 Russian, 2 Western.
[126-2415]

USSR UDC 621.382

DETERMINATION OF SEVERAL ELECTROPHYSICAL PARAMETERS OF INTEGRATED-CIRCUIT STRUCTURES BY A PHOTOELECTRICAL METHOD

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 73-78
manuscript received 19 Mar 79

BUGROV, V. YA., VOROB'YEV, A. V., MOSHKIN, V. I., RODIONOV, YU. P. and SHAROV, A. A.

[Abstract] A nondestructive photoelectrical method is proposed for simultaneous measurement of several electrophysical parameters of integrated-circuit structures. It involves matching, by minimization of the difference, the experimentally determined and the theoretically calculated quantum efficiency spectrum of a p-n junction under test. The theoretical

spectrum is based on the mathematical model for the spectral photosensitivity proportional to the quantum efficiency and the latter dependent on seven parameters (mean lengths of the diffusion path and diffusion coefficients for minority carriers in the p-region and in the n-region, rate of surface recombination, light absorption coefficient and depth of junction embedment). The test equipment includes a photometric lamp, a lens, a monochromator, a rotating mirror, a calibrated photodiode, two probes and a recording instrument. A computer program has been written for evaluating the readings and calculating the parameters. The method is applicable to bipolar and MOS structures. Figures 5; tables 1; references 7: 4 Russian, 3 Western [1 translated].
[126-2415]

USSR UDC 621.391:621.327.8

A PULSED NOISE RECORDER

PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1979 pp 32-33

SEMENYAK, A. YU., SARKISOV, A. M., engineers and GUTNIK, YE. I., Candidate in Technical Sciences

[Abstract] A pulsed noise recorder has been developed at "Promavtomatika" Scientific-Production Association at Groznyy. The device can count the number of noise pulses exceeding a fixed level of both amplitude and duration (range of selection 5 ns to 10 μs in length, 0.3 to 60 V in amplitude) and record them on a strip-chart recorder. A block diagram of the device is presented, plus a diagram of the frequency of appearance of noise pulses exceeding the selection level in an actual communication channel used in the automated system for control of technology processes [ASUTP] of a 1500 rolling mill at a metallurgical plant. The information can be used for planning purposes in development of data transmission systems for process control systems. Figures 2; references: 3 Russian.
[[illegible]-2415]

USSR UDC 621.382

'SUPERCOMPONENTS' ON THE BASIS OF VERY-LARGE-SCALE INTEGRATED MEMORY CIRCUITS AS AN ELEMENTARY BASE FOR FOURTH-GENERATION DIGITAL SYSTEMS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 3-14
manuscript received 5 Apr 79

ALEKSENKO, A. G. and LAPSHINSKIY, V. A.

[Abstract] The main structural features of fourth-generation digital systems are a multiprocessor organization with arterial links at all levels, microprogrammatic control and intelligent peripheral equipment. These systems, with very-large-scale integration, are considered for the base of memory systems. The "supercomponent" approach to the design of such systems, intermediate between "strict" separation of arithmetic-logic processing functions from storage of processed and control data and their integration into a single universal cell, seems to be most promising. Here, on the basis of standard structure of a memory subsystem, the design requirements for a 65 kbit dynamic supercomponent memory with very-large-scale integration are examined and the necessary hardware in a processor-oriented organization is evaluated, this organization also being compared to various other ones. The universality of a supercomponent memory and a unified organization for achieving this purpose are taken into consideration. Such a supercomponent memory structurally organized on a 25-30 mm^2 large area of a single chip is feasible, morphological integration being possible as the data volume continues to increase, and with auxiliary control functions preferably included in the memory for hardware optimization. Figures 6; tables 1; references 11: 9 Russian, 2 Western.
[126-2415]

USSR UDC 621.383.6

OPTOELECTRONIC SWITCH OF LOGICAL SIGNALS

Leningrad IZV.VUZ:PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79
pp 84-87 manuscript received 26 Feb 79

SHAROV, V. P., IZ'YUROVA, G. T., TEREKHOV, V. A. and SEROV, V. N.

[Abstract] A circuit is developed for a high-speed optoelectronic switch of logical signals such as is effectively used for high-speed transmission of digital information. The switch is suited for realization in integral form by standard technology methods. A machine analysis of the circuit operation made it possible by the introduction of an additional resistor to diminish its sensitivity to variance of the parameters of active components. The paper was recommended by the Department (Kafedra) of Industrial Electronics, Moscow Institute of Radio Engineering, Electronics and Automatics. Figures 4; references 3: 2 Russian, 1 Western.
[120-6415]

USSR

AUTOMATIC OPTICAL READERS

Moscow RADIO in Russian No 12, 1979 pp 15-16, insert

VOZIYANOV, A.

[Abstract] A description is given of automatic optical readers which make it possible to enter information directly into a computer from original documents. Work on the creation of automatic readers is under way in Minsk, where the "Blank" reader is being developed, and in Vil'nyus, where the "Ruta-701" reader has successfully passed tests. Both of these units are being series produced. In Moscow the YeS-6035 has been created, which can be used as an input unit for YeS [Unified System] computers. This unit can read digits and capital and lower-case letters written in the Cyrillic and Roman alphabets in stylized "ROS-B" script specially developed for this purpose. This unit can read 500 characters per second and has an error rate of not greater than $3 \cdot 10^{-6}$ and a failure rate of not greater than $3 \cdot 10^{-5}$. These units read information written on a typewriter or carefully by hand in a special format on special paper. One letter is written in a block preprinted on the paper and blocks sometimes have a grid for indicating where parts of a letter (or character) are to be written. Documents are fed into the reader through rollers and are wrapped around a drum, one sheet at a time. The drum is turned by a motor and each line on the document

is scanned by a reading head containing a bank of photodiodes. A light source illuminates the document as it turns on the drum. The reading head analyzes the shape, dimensions and relative position of character images. The images of characters are digitized and converted into electrical signals. An analysis is made of each cell of the square in which a character is written and a determination is made of whether it is white or black. A binary representation of the image is thus produced. The cells are read by individual photodiodes or photomultipliers, which measure the average brightness of each of them. An illustration is given of a reading head employing a bank of photodiodes. The image is analyzed by a recognizer, which compares the image being analyzed with standards. Star networks of resistors are employed in the model illustrated, in which an individual star network is employed for each standard. The total current of the star network is proportional to the amount of agreement of the image with the standard. A determination is made of the number of the standard showing maximum agreement and a response unit generates a code for this number, which enters the working storage of a minicomputer. The responses received are transmitted by means of an arithmetic-logic unit either to an interim medium or to the computer for which the read information is intended. This recognition method does not make it possible to recognize hand-written characters or characters printed in different scripts. For this purpose more complicated algorithms are employed, called algorithms for structural analysis, which analyze the existence of certain traits of a character and the relative position of elements of the image. The reader includes a unit for manually entering unrecognized characters, i.e., when the reader does not recognize a character on a document and a signal is given for the operator to analyze it and enter the proper code. In spite of their advantages, automatic readers have not become widespread, chiefly because of their cost and their limited capabilities, i.e., the need for documents of a special form and for carefully written script of a certain kind. There are also special requirements for the paper, storage conditions and the transportation of documents. It is hoped that the further development of new integrated circuits will make it possible to use better recognition algorithms and to expand the capabilities of the unit. Figures 3.
[108-8831]

USSR UDC 621.373

ANALYSIS OF INFRALOW FREQUENCY GENERATORS BASED ON DEVICES WITH AN N-SHAPED CURRENT-VOLTAGE CHARACTERISTIC

Leningrad IZV. VUZ. PRIBOROSTROYENIYE in Russian Vol 22, No 11, Nov 79
pp 76-79 manuscript received 14 Jun 78

D'YAKONOV, V. P. and STERLYAGO, A. A.

[Abstract] If stability of the pulse duration (or the pulse recurrence frequency) does not play a significant role, then as a time control element of generators of low and infralow frequency, it is advisable to use a thermistor, the resistance of which varies in time in the case of its heating or cooling. Ordinarily, generators with a time control thermistor are constructed on the basis of amplifiers with feed back and are characterized by a relative complexity and a narrow range of control. In the present paper an analysis is made of a generator based on devices with a N-shaped current-voltage which eliminates these shortcomings, and the principal parameters of the generator are determined. This paper was recommended by the Department (Kafedra) of Industrial Electronics, Smolensk Affiliate of the Moscow Power Engineering Institute. Figures 3; references: 4 Russian.
[120-6415]

Power Systems [Including Effect of Various Items on Power Transmission]

USSR UDC 621.3.027.3.015

OVERVOLTAGES IN SHAPING AND TRANSMITTING LINES OF NANOSECOND PULSE GENERATORS

Minsk IZV.VUZ: ENERGETIKA in Russian No 10, Oct 79 pp 29-32 manuscript received 12 Mar 79

PCHELINTSEV, YU. K., engineer

[Abstract] A study is made of overvoltages which reach their maximum value in the internal parts of the line of a nanosecond pulse generator. The line is considered to be loaded with a series RC circuit. Under these conditions, the overvoltage on the inner portion of the line may be as great as triple the nominal operating voltage. The paper was presented by the Department (Kafedra) of High Voltage Sources, Leningrad Order of Lenin Polytechnical Institute imeni M. I. Kalinin. Figures 1; references: 4 Russian. [112-6508]

USSR UDC 621.3.082.4:625.781

COMBINATION OF INDUCTION AND ACOUSTICAL EQUIPMENT FOR DETERMINING LOCATION OF DAMAGE IN CABLE LINES

Moscow ENERGETIK in Russian No 11, 1979 pp 28-29

MOLOKANOV, M. V., engineer and SPIRIDONOV, V. K., candidate in technical sciences, All-Union Scientific Research Institute of Electric Power Engineering, Moscow (VNIIE)

[Abstract] A description is given of a newly developed set of equipment which employs induction and acoustical methods of locating damage to insulation in three-phase power cables. The equipment consists of a type GK-77 generator and of a receiver with inductive and acoustical transducers which has been given the name the type KAI-77 cable probe. By the induction method a determination is made of the route and bed depth of the cable and the location of single-phase and interphase short circuits. In the search mode high-frequency current is passed through the cable from the GK-77 generator. The magnetic field created by this current in the cable induces a voltage in an I-77 inductive transducer, which is moved along the cable route. The induced voltage is amplified by the cable probe's amplifier and the signal is heard through a headphone or is indicated by a pointer on the probe. In the acoustical mode are determined points of damage associated with high-voltage discharges. The acoustical vibrations which originate in the case of cable breakdown are picked up by an acoustical transducer which is placed on the surface of the ground over the route of the cable line. The transducer converts the vibrations into an electrical signal which is amplified by the probe's amplifier. These signals are monitored by a headphone and a meter. The high sensitivity and selectivity of the cable probe, especially when operating at a frequency of 10,000 Hz, drastically reduces the influence of electromagnetic noise and makes it possible to use a lightweight portable generator of the GK-77 type rated at 150 W, with reliable signal reception. The GK-77 generator operates at a frequency of 1000±10 or 10,000±100 Hz, has a maximum current of 25 A and a maximum voltage of 500 V and a power requirement of 250 V·A. It weighs 15 kg and measures 400 X 270 X 150 mm overall. The KAI-77 cable probe together with the inductive transducer picks up a variable magnetic field with a strength of 0.5 mA/m at 1000 Hz or 0.05 mA/m at 10,000 Hz, thus making possible a voltage at the TA-56m headphone's plug of not less than 0.5 V. The cable probe is powered by two 4.5 V type 3336 batteries and has a power requirement of 10 mA. This instrument can still operate when the supply voltage is reduced to 6 V. The probe weighs 2 kg and measures 210 X 95 X 120 mm. Structural diagrams are given of both the GK-77 generator and the KAI-77 cable probe. The GK-77 generator is powered from a 220 V, 50 Hz main. Two master oscillators serve as the signal source for exciting the power amplifier, which has several amplification stages to provide the required power at the generator's output. The cable probe consists of three series-connected amplifiers, whose functions are described in detail. The I-77 inductive transducer consists of an induction coil with a ferrite core and capacitors used for tuning the coil to frequencies of 1 and 10 kHz. The induction coil is in a Bakelite case to protect it from physical damage and the transducer is fastened to a rod so that the detector can be moved directly over the surface of the ground. The A-77 acoustical transducer is in the form of a heavy waterproof case inside of which there is a piezoelectric system. The acoustical transducer is well shielded against external electromagnetic radiation. The induction and acoustical transducers are connected to the cable probe by means of a flexible shielded wire and a plug. Figures 2. [107-85[illegible]]

UDC 621.311.153

PREDICTION OF ELECTRIC POWER CONSUMPTION OF COMBINED POWER SYSTEMS BASED ON THE DATA OF ONE POWER SYSTEM

Minsk [illegible]: ENERGETIKA in Russian No 10, Oct 79 pp 81-84 manuscript received 7 May 79

[illegible], A. M., candidate in technical sciences and BELOV, A. O., engineer, [illegible] (affiliation unknown); "Kalininenergo" (Kalinin Power)

[Abstract] Studies performed by the authors demonstrate that there is a close linear correlation between the power consumption of the combined power systems of the USSR, with correlation coefficients of 0.991÷0.910. Series of absolute monthly maxima of electric power consumption and mean monthly values of power consumption during 1970-1975 were studied for all of the combined power systems of the USSR. The statistical methods suggested can predict the power consumption of combined power systems based on the data of one power system in the combination considering the minimum qualtity of statistical data. Figures 2; tables 1; references: 3 Russian. [112-6508]

USSR UDC 621.315.2.016.2

EMPLOYMENT OF MOBILE LABORATORIES IN ERECTING 110 kV CABLE LINES

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 11, 1979 pp 52-53

SKORIK, V. P., engineer

[Abstract] In the erection of cable lines the existing stationary chemistry laboratories of energy administrations do not make it possible to conduct timely, high-quality complete tests of cables, particularly with regard to determination of the breakdown voltage and dielectric loss tangent at the point where the cable is farmed out. Therefore, mobile electrochemical laboratories have been employed. A description is given of the [illegible]-1M mobile electrochemical laboratory designed for making analyses of MN-4 cable oil in the installation of 110 kV cable lines. The laboratory is contained in a heated car mounted on an IAPZ-754V trailer. This laboratory is equipped with equipment and reagents for determining the following parameters: acidity and pH number; content of water-soluble acids and alkalis; breakdown voltage; dielectric loss tangent; and electrophysical indicators, such as the dielectric constant and resistivity. The content of dissolved gas is determined by means of an instrument which is part of the gas cleansing unit. The stability and moisture content of the cable oil are not checked, since these are guaranteed by the manufacturer. The laboratory includes an M4100/5 megohmmeter rated at 2500 V for field tests of cable for integrity of cores. A determination of the saturation factor characterizing the gas content in the insulation as well as tests for the free flow of oil are performed directly at the cable drum or jointing device. The mobile laboratory has been constructed to take into account all safety requirements with regard to vibration-proofing, ventilation, fireproofing, storage of chemicals, and the like. The laboratory contains a water line which can be connected to a city water supply, and also a waste disposal system. A built-in water tank and heater make possible a supply of hot and cold water. Under field conditions water can be fed to

the tank from any reservoir with clean water by means of hand-operated or electric pumps. The laboratory is also furnished with an analytical balance, fluorescent lights and a convective air circulation system making it possible to weigh with an accuracy of 0.01 g. The dielectric loss tangent is determined according to a special measuring system at a temperature of 100±1°C. The oil is poured into cylindrical measuring electrodes and heated in a thermostat-controlled 2V-151 unit. Oil is tested for breakdown with an AIM-80 unit. All electrical equipment is grounded by means of an internal grounding circuit and a fire extinguishing and alarm system is provided. When in use, the laboratory is set on a level area with a hard covering and it is set strictly horizontal by means of bracing jacks. The laboratory can perform five or more different types of analysis. Its ventilating system circulates 30 m^3/h of air, it includes 4 RTM electrical radiators for heating, it has 16 m^3 of space, its power network is 380 V, its power requirement is equal to or less than 22 kV, it can travel at a maximum speed of 30 km/h, it weighs 4200 kg, and its dimensions are 4 m long by 2.2 m wide by 3.52 m high. The laboratory is staffed by two specially trained people. The efficiency of using these mobile laboratories has been demonstrated in the installation of 110 kV cable lines in Kiev, Severodonetsk and Lipetsk. Figures 1.
[109-8831]

USSR UDC 621.315.66

WAYS OF IMPROVING DESIGNS OF SUPPORTS FOR 500-kV-AND-UP OVERHEAD LINES

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 11, 1979 pp 48-51

PETERSON, L. L., engineer, and KURNOSOV, A. I. and GABLIYA, YU. A., candidates in technical sciences

[Abstract] In the USSR, for the purpose of distributing the power of just the largest of the country's electric power plants, it will be necessary in the future to construct a few thousand kilometers of 500 to 1150 kV overhead lines. These will mainly be electrotransmission lines connecting the European sector of the country with the Ekibastuz Energy Complex and Surgut GRES (State regional electric power plant). The lines will pass over heavily swampy areas and through regions with permafrost. There are few roads and railroads in this area. The designs of supports and foundations for 500-kV-and-up overhead lines are determined by the voltage of the lines and the territory they pass through. An analysis is made of different types of supports in terms of their construction, the voltage range for which they are appropriate, and the climate regions in which they can be used, with particular emphasis on their appropriateness for ice-covered ground and resistance to wind. Their dimensions are given, as well as their

overall span, their average span, the number of supports required per kilometer, their weight, and their metal content. Experience has shown that supports with various guy constructions are best as intermediate supports. The most widespread type of support with a guy design is a portal type with guys. These are used chiefly as supports for 500 kV overhead lines. A disadvantage of them is the complexity of installing them on slopes. Portal-type supports have been developed for 750 kV overhead lines and the pitch of pedestals of portal supports has been increased from 1:10 to 1:5. A disadvantage of portal-type supports employing guys is the somewhat high dependence of stresses in a leeward pedestal on the amount of strain in the support in the plane of the portal. A more intelligent use of the metal in a support is illustrated by the design of "Chayka" supports in which the same pedestal is stressed with any direction of the wind. These are designed for both 500 kV and 750 kV lines. The employment of V-type supports has made possible the most satisfactory solution to the problem of installing the middle stage. In the USSR a system with divided guys is used for V-type supports. This system makes possible a better use of metal than in the Canadian design, which employs single guys. Sometimes for 750 kV lines are used ferroconcrete supports of the portal type with inside ties made of cylindrical tubes 20 m long and 800 mm in diameter. All of the above supports have a rigid traverse. Also discussed are supports with a guy type of traverse. At the present time methods are lacking which would make it possible to determine the parameters of supports with a guy type of traverse which besides maximum savings would afford also mechanical reliability and stability in electrotransmission lines. The main difference between portal-type supports with guy traverses and supports with ordinary traverses is the great mobility in points for fastening insulator chains. Supports with a guy traverse consist as a rule of two pylons and a system of flexible ties on which the wires are hung. The pylons can be vertical or inclined. Variants of this design are discussed. Anchor supports are also considered and the most intelligent for 500 and 750 kV lines are thought to be free-standing three-pedestal angle-suspension anchor supports. The pedestals of these supports are independent of one another. Having the best economic indicators are supports with guy-type traverses. It is recommended that for 500 and 750 kV overhead lines portal-type supports and V-type supports with divided guys be used. Their specific ranges of application must take grounding requirements into account. Supports with a guy traverse are recommended for superhigh voltage lines and primarily for 750 and 1150 k lines. The consumption of metal for these types of supports is 30 to 35 percent lower than for supports with guys of the ordinary construction. The employment of this design will result in a savings of about 150,000 rubles per 100 km of a line. It is recommended that anchor suspension supports be of the freely standing three-pedestal type of minimum height in accordance with grounding requirements. Figures 4; tables 1; references 2: 1 Russian, 1 Western.

[109-8831]

USSR UDC 621.316.925:681.32(0.75)

ANALYSIS OF THE CAPABILITIES OF MICROPROCESSOR SYSTEMS DESIGNED TO PERFORM RELAY PROTECTION FUNCTION

Minsk IZV.VUZ: ENERGETIKA in Russian No 10, Oct 79 pp 15-19 manuscript received 1 Jun 79

NOVASH, V. I., doctor in technical sciences, Professor and SHEVTSOV, YE. I., engineer

[Abstract] One problem related to relay protection using digital equipment is the development of the structure of the control computer system. The use of specialized peripheral hardware increases the quantity of equipment which cannot be used for other purposes and must be specially manufactured. However, the use of general purpose microprocessors, specialized by the software which they contain, relieves this problem. Some of the properties of multiple microprocessor systems designed for relay protection purposes are outlined. Essential properties include speed, reliability and economy. A graph illustrates the variation in cost of data transmission systems as a function of data transmission rate in bits per second. Interestingly, the graph expresses the cost in dollars. Multiple microprocessor systems can in principle perform most of the main tasks related to the provision of reliable and economical digital protection of large power system units. The optimal hardware and software configurations have not yet been determined. The paper was presented by the Department (Kafedra) of Electrical Stations, Belorussian Order of Labor Red Banner Polytechnical Institute. Figures 2; references: 3 Russian.
[112-6-08]

USSR UDC 621.373.8

MASER AMPLIFICATION AT 40-60 GHz FREQUENCIES IN A SLOW-WAVE SYSTEM WITH ANDALUSITE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2154-2156 manuscript received 6 Mar 78

CHERPAK, N. T., MYSHENKO, V. V., PESKOVATSKIY, S. A. and SMIRNOVA, T. A.

[Abstract] The first problem in producing a paramagnetic traveling-wave maser amplifier is to find an appropriate active crystal and to design a slow-wave structure. The parameters which determine the suitability of both for this purpose are the gross gain and the paramagnetic (electronic) gain per unit length of the crystal, the difference between them being equal to the attenuation per unit length of the slow-wave structure. A reliable final selection for such an amplifier and millimeter waves, based on attainable performance characteristics, requires a direct experimental evaluation. The results of such experiments indicate that an andalusite crystal ($0.5 \times 0.8 \times 5.5$ mm^3) with an Fe^{3+} ion impurity (dielectric constant $\simeq 8$) and a matching digital slow-wave structure at a temperature of 1.7-2 K yield a paramagnetic gain higher than 30 dB/cm. Such an amplifier has a bandwidth of at least 40 MHz. The technically feasible magnitude of the magnetic decrement for such a crystal is limited by the smallness of the digital structure. Figures 1; references 10: 7 Russian, 3 Western.
[118-2415]

USSR UDC 539.216

BUILDUP KINETICS, STRUCTURE AND ELECTRICAL PROPERTIES OF RESISTIVE RS-1004 ALLOY FILMS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 61-65
manuscript received 17 May 79

OSADCHENKO, V. A., TROFIMOV, V. I. and SELIVĚRSTOV, L. A.

[Abstract] High-resistivity (> 20 kohm/square) thin films of RS-1004 alloy (silicon with 10 percent Ni + 4 percent Fe) grown by discrete-pulse vapor deposition on various substrates at various temperatures were studied with the aid of an electron microscope and by diffraction analysis. Data on the kinetics of film buildup on KCl substrates at 400°C were evaluated according to Kolmogorov's exponential law. For determining the dependence of the kinematics and of the resulting structure on the substrate material and its temperature, LiF crystals and amorphous carbon were also used as substrates at temperatures from 315 to 550°C. Electrical properties of the films, namely the surface resistivity and the temperature coefficient of resistivity, were measured on pyroceramic substrates. The increase of surface resistivity with rising temperature is attributed to a transition from amorphous to crystalline film formation. The stability of films built up at various substrate temperatures was, furthermore, tested for 2000 h at 125°C and found at first to increase with higher substrate temperatures during the deposition process, up to the crystallization temperature, and then to decrease again. Figures 5; references 11: 6 Russian, 5 Western.
[126-2415]

USSR UDC 548.316

EXAMINATION OF ELECTRICALLY ACTIVE DEFECTS IN SILICON WAFERS UNDER A RASTER-TYPE ELECTRON MICROSCOPE

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 48-53
manuscript received 4 Jun 79

KARELIN, N. M., KUSAKIN, S. I., LITVINOV, YU. M., RAU, E. I. and SPIVAK, G.V.

[Abstract] Electrically active silicon wafers were examined under a raster-type electron microscope operating in the induced-current mode with a metal (aluminum)-semiconductor Schottky junction instead of a p-n junction, in an experiment with macroscopically dislocationless p-Si crystals grown by the Czochralski method in the <111> direction to an electrical resistivity of

$10\ \Omega \cdot$cm. The effect of defects in single crystals on the parameters of semiconductor devices was studied successively through the stages of oxidation, epitaxial growth and diffusion doping. Vacancies and clusters were found to be fully retained through all process stages, while dislocations and mechanical microcracks were found to disappear partly during stress relieving by annealing. Various defective formations cause parasitic bonding of active elements to a substrate, thus increasing the leakage and lowering the response speed. Figures 4; references 11: 4 Russian, 7 Western [1 translated].
[126-2415]

USSR UDC 620.179.11

INSPECTING THE RESULTS OF CHEMICAL TREATMENT OF SILICON BY CONTACTLESS METHODS

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 82-85
manuscript received 24 Apr 79

ZHARKIKH, YU. S. and YEVDOKIMOV, A. D.

[Abstract] Two contactless methods were used in inspection of chemically treated silicon wafers for surface homogeneity and purity. Acidic treatment of silicon consisted of chemico-mechanical polishing with subsequent rinsing in toluene, rinsing in H_2SO_4 + washing in H_2O, rinsing in HNO_3 + washing in H_2O, and brushing in H_2O. Perhydrol treatment consisted of chemico-mechanical polishing, rinsing in toluene, rinsing in $NH_4 \cdot OH + H_2O_2 + H_2O$ + washing in H_2O, rinsing in $HCl + H_2O_2 + H_2O + HNO_3$ + washing in H_2O, and brushing in H_2O. In the first method of inspection the contact potential difference was measured along any coordinate line on the wafer surface, before and after each stage of treatment, and the continuous profile thus recorded then broken up into many points (approximately 400 per wafer). Treatment with water was found, for instance, to reduce the negative charge on a silicon surface. In the second method of inspection the photo-emf was measured across a silicon wafer and a semitranslucent metal electrode, both 50 μm apart, with a laser beam (wavelength 0.63 μm, light spot 0.5 mm in diameter) scanning the silicon surface and an oscillograph recording the signals after their amplification. The second method reveals surface inhomogeneities remaining after each stage of treatment and, unlike the first method, is also applicable to inspection of the Si-SiO_2 interface. Figures 2; references 8: 6 Russian, 2 Western.
[12[illegible]-2415]

USSR UDC 621.317.3:537.533.5

DIELECTRIC CHARACTERISTICS OF MgO FILMS PRODUCED BY VARIOUS METHODS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 10, Oct 79
pp 2162-2165 manuscript received 13 Feb 78

LYAMIN, A. A., SHAPIKOV, G. A., KORNILOVSKIY, YE. U. and VOLKOV, V. V.

[Abstract] Dielectric MgO films were produced by three different techniques of vacuum deposition: oxidation of metallic magnesium during slow evaporation in molecular oxygen, oxidation of metallic magnesium during evaporation in ionized oxygen, and evaporation of magnesium oxide with an electron beam from pellets of mechanically pressed powder. Specimens of each were tested for determining the dependence of secondary electron emission on the energy of primary electrons, the time dependence of discharge due to leakage, the field dependence of their electrical conductivity, and their dielectric permittivity indirectly from other measurements. All these characteristics were found to be influenced by the technology, MgO films produced with an electron beam having a lower dielectric permittivity and a lower coefficient of secondary electron emission but a higher electrical conductivity than the other films. The general trends of these characteristics were, however, found to be the same for all three types of specimens. Figures 3; references: 5 Russian.
[118-2415]

USSR UDC 621.373.132

KINETICS OF THERMAL CROWDING WITH FLUCTUATION INSTABILITY IN TRANSISTOR STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 168-176 manuscript received 21 Aug 78

KERNER, B. S., NECHAYEV, A. M., RUBAKHA, YE. A. and SINKEVICH, V. F.

[Abstract] It has been theoretically and experimentally demonstrated that failures of power transistors are due mainly to inhomogeneous distribution of current and temperature--crowding. The authors use a computer modeling approach to study the principal characteristics and kinetics of formation of steady-state current and temperature crowding as thermal instability of homogeneous current distribution develops in a homogeneous transistor structure. An investigation is made of the way that the time characteristics of this process depend on the working conditions and parameters of the structure, and the way that the working conditions and parameters influence

the characteristic dimensions of the current and temperature crowding. The external characteristic $V_{EB}(V_{CB})$ is studied as a function of the parameters of the inhomogeneous distributions of temperature and current. It is found that when the initial fluctuations are low in amplitude, and the voltages V_{CB} are slightly greater than V_{cr}. The time of exponential rise in fluctuations is much greater than the time of "macroscopic" redistribution of current density and temperature in the structure of the transistors. "Macroscopic" redistribution of the current density and temperature and formation of an inhomogeneous steady state (crowding) are accompanied by a rapid drop [illegible]. The increment of the rise in temperature and current density fluctuations that characterize the initial stage of development of thermal instability, and also the quantity that is inversely proportional to the time of "macroscopic" redistribution are linearly dependent on the collector voltage. There is an increase in the characteristics dimensions of crowding with increasing total current. The dimensions of crowding are nearly inversely proportional to V_{CB} in the investigated voltage range. An increase in V_{CB} causes a nearly linear rise in the maximum temperature of an inhomogeneity. The slope dT_{max}/V_{CB} is steeper than for the case with unchanged current distribution because of the change in dimensions of crowding. Similar behavior is observed with a change in total current. The section of the external characteristic $V_{EB}(V_{CB})$ that corresponds to inhomogeneous current distribution is close to linear in the investigated voltage range. T_{max} can be measured indirectly from the linear relation $V_{EB}(T_{max})$ on sections of homogeneous and inhomogeneous current distributions. Figures 5; references 10: 5 Russian, 5 Western.
[123-6610]

USSR UDC 621.382

INTERBAND ABSORPTION IN n-InSb SINGLE-CRYSTAL FILMS IN AN ELECTRIC FIELD

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 75-82
manuscript received 4 Jul 79

RZHANOV, A. YE., DAZAREV, S. D., LUTSKIY, O. N. and RYZHIY, V. I.

[Abstract] An experimental study was made of intraband absorption in n-InSb single-crystal films in an electric field alone or in crossing electric and magnetic fields. The carrier concentration was $(7-9)\cdot 10^{13}$ cm^{-3} and the electron mobility was $(6-7)\cdot 10^{5}$ cm^{2}/V·s. Electric fields of up to 29 V/cm intensity ($j = 6.1$ A/cm^{2}) were applied and, according to the transmission spectra, already a weak electric field of 6 V/cm intensity was found to lower the absorption limit by approximately $5\cdot 10^{-4}$ eV. This cannot be

explained by the Franz-Keldysh effect, which would require a much higher electric field intensity, but is explained here by heating of electrons with a consequent lowering of the Fermi levels. The results were similar in an electric field with a quantizing magnetic field also present. The energy corresponding to the absorption limit was, furthermore, found to decrease with rising temperature. The authors thank B. A. [illegible], S. G. KALENKOV, YE. F. [illegible], V. F., GANTMAKHER, who chaired the seminar, and also other participants for the discussion and helpful comments. Figures 4; references 4: 3 Russian, 1 Western.
[126-2415]

USSR UDC 621.382

S-SHAPE CHARACTERISTICS OF AN MOS-TRANSISTOR

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 85-86
manuscript received 15 Mar 79

GROMOV, D. V., KOSTYRNINA, G. P. and GROMOV, I. S.

[Abstract] An MOS transistor can also perform the function of a bipolar transistor. In this case the emitter becomes the source and the collector becomes the drain, with the substrate acting as the base. A high current gain is attainable with a sufficiently small distance between source and drain. An S-shape current-voltage characteristic can be produced by building in an n-type conduction channel, applying a negative voltage to the base and shorting the drain and the gate together as well as to the case. Avalanche breakdown in the p-n junction will occur at a sufficiently high negative voltage at the substrate. The peak voltage and thus the shape of the curve can be varied by applying a bias voltage to the gate, with the latter disconnected from the drain as well as from the source. Figures 3; references 3: 2 Russian, 1 Western.
[126-2415]

USSR UDC 621.382.333

PARTICULARS OF AVALANCHE CURRENT MULTIPLICATION IN GERMANIUM TRANSISTOR STRUCTURES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
manuscript received 31 Oct 78

GAVRILOV, L. YE.

[Abstract] The Miller formula for avalanche multiplication of current in the collector junctions of transistors is not applicable to a germanium diffused-alloy transistor. In these structures, when the emitter junction is blocked, current multiplication is initiated by the thermal current of the collector junction, chiefly due to diffusion of minority carriers from the high-resistance collector. When the emitter junction is open, multiplication is initiated by the carriers that are minority with respect to the base. The author proposes a new method for calculating the coefficient of avalanche multiplication of current in transistor structures with consideration of these peculiarities. The proposed technique is applicable to germanium alloy, drift and epitaxial transistors. Formulas are derived that account for the interaction between junctions and the dopant distributions characteristic of present-day transistors. The interaction between junctions causes the coefficients of avalanche multiplication to depend on current when the emitter junction operates in the micromode. This mode is typical of the section of the output current-voltage curves of avalanche transistors in a common-emitter circuit up to the point of negative differential resistance. The author thanks T. M. Agakhanyan and A. D. Chesnokov for constructive criticism and support of the work. Figures 6; tables 1; references 18: 10 Russian, 8 Western.
[123-6610]

USSR

SERIES KP901 AND KP902 FIELD EFFECT TRANSISTORS

Moscow RADIO in Russian No 12, 1979 p 56

BAMOV, A.

[Abstract] Much attention is being paid presently to the creation of high-power field effect transistors, chiefly because of their high temperature stability as compared with high-power bipolar transistors. Unlike bipolar transistors, with an increase in the temperature of the environment the static and dynamic slope of the characteristic of field effect transistors is reduced and self-heating of the transistor does not take place. Reference data are given on series KP901 and KP902 field effect transistors, which are planar transistors with an MOS (metal-oxide semiconductor) structure and an *n*-type channel. These are designed for broadband receiving-and-amplifying and transmitting equipment for a wide range of applications. These transistors are contained in a metal ceramic sealed case with a mounting screw. Series KP901 field effect transistors have a transfer characteristic slope of not less than 50 mA/V for the KP901A and 60 mA/V for the KP901B, with U_{SI} [drain-source] = 20 V and I_S [drain] = 0.5 A. This figure

is 10 mA/V for the KP902 with U_{SI} and I_S equal to 50 mA. The KP902B has a noise factor of not greater than 6 dB, and the KP902V of not more than 8 dB, with U_{SI} = 50 V, I_S = 50 mA and f = 250 MHz. The power gain of series KP902 transistors is not greater than 15.4 dB with U_{SI} = 50 V, I_S = 50 mA and f = 250 MHz. The output power of series KP902 transistors is not greater than 1.5 W with f = 60 MHz. The maximum permissible operating conditions for series KP901 and KP902 transistors, respectively, are as follows: voltage between drain and source, 70 and 50 V, respectively; pulsed voltage between drain and source with a pulse duration of 1 ms and Q = 70, 85 and 70 V; maximum gate-source voltage, 30 and 30 V; drain current, 4A and 200 mA; and dissipated power in drain, 20 and 3.5 W. Figures 1.
[108-8831]

USSR UDC 621.383

PHOTOELECTRICAL CHARACTERISTICS OF TRANSISTOR MATRICES WITH CHARGE STORAGE

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 43-47
manuscript received 7 Aug 78

VORONOV, YU. A. and MOCHALKINA, O. R.

[Abstract] When the size of photoelectric image converters on a silicon-transistor receiver matrix with charge storage is increased, there appear parasitic effects which alter the initial converter performance parameters: threshold sensitivity and dynamic range. Here these parasitic effects which occur under conditions of nonideal discharge and without control busbars are examined on the basis of a simulation experiment. An MxN photo-transistor matrix is considered, M rows connecting the emitters and N columns connecting the collectors. The model for analyzing the photoelectrical characteristics includes performance degradation due to capacitive and resistive coupling between isolated regions, to the finite resistance of an open transistor switch, to the total stray capacitance of all emitter junctions in a row, and to the resistance of collector busbars. Calculations were made on an M-220 computer according to the PA-1M program, assuming the collector columns to be isolated either by a p-n junction, thin dielectric films, or thick dielectric films. Voltage pulses from four generators simulated the output signals of the interrogator system and the voltage of a constant-voltage source simulated the output voltage of the commutator in its logic "0" state. The amplitude of the output voltage signal due to a charge flowing from the storage capacitor during the integration period is found to build up to the highest level with least charge in the case of a discrete photoreceiver and to the lowest level or with most charge in the case of thick or thin dielectric isolating films

respectively. In the case of an isolating p-n junction, moreover, the voltage amplitude is found to decrease with increasing matrix size. The dynamic range decreases and the threshold sensitivity increases with increasing matrix size, while the threshold sensitivity also increases with increasing capacitance of the isolating region. These results are useful for optimizing the matrix size and the insulation system. Figures 4; references 5: 4 Russian, 1 Western.
[126-2415]

USSR UDC 621.383

BISTABLE PROPERTIES OF A LIQUID-CRYSTAL CELL WITH FEEDBACK

Moscow MIKROELEKTRONIKA in Russian Vol 9, No 1, Jan-Feb 80 pp 87-89
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VASIL'YEV, A. A., KOMPANETS, I. N. and PARFENOV, A. V.

[Abstract] Development of optical digital methods of data processing is impeded by a lack of elements with bistable properties. Attempts have been made to ensure bistability and nonlinearity by means of optical or electrical positive feedback. This is possible, for instance, with a liquid-crystal cell. The apparatus consists of a laser, a variable absorber, a polarizer, a nematic crystal with a twist structure, an analyzer initially oriented orthogonally to the polarization vector of light emerging from the twist cell, and a symmetric metal-dielectric-semiconductor-dielectric-metal structure operating in the photovaractor mode. This structure and the twist cell are also connected in series across a common voltage supply and they form the positive feedback loop. Transmission of light is controlled by the supply voltage and is augmented by an avalanche effect. The relation between voltage and transmission is strongly hysteretic, as is the relation between the intensity of transmitted light and the intensity of incident light. It has been possible to attain a maximum optical contrast of 100:1 with an overall transmission efficiency of 50-60 percent, using a nematic liquid crystal of the 2/3-BMAOB + 1/3-BOAOB + 12 percent TsFeG k mixture with a positive dielectric anisotropy $\Delta\varepsilon \approx 3$. A switching speed of 10-25 ms was attained, using a supply of 8 V at 600 Hz, but a switching speed of 10^{-5} s should be possible with a properly modified crystal mixture. It is also possible, with the twist cell disoriented, to switch between peaks of S-effect transmission in the liquid crystal. The authors thank L. M. BLINOV for the helpful discussion and V. V. TITOV and V. T. LAZAREVA for supplying liquid crystals. Figures 2; references 7: 4 Russian, 3 Western.
[126-2415]

USSR UDC 621.391.822.537.533.2

PECULIARITIES OF FLICKER-NOISE OF SILICON FIELD EMITTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 25, No 1, Jan 80
pp 217-219 manuscript received 12 Apr 78

BAKHTIZIN, R. Z. and GOTS, S. S.

[Abstract] The paper gives some results of an investigation of the noises in a silicon field emitter. The main experiments were done on p-type crystals with resistivity of 2000 $\Omega\cdot$cm in a vacuum of 10^{-9} mm Hg. The current-voltage characteristics of such field emitters are appreciably nonlinear and have a typical light-sensitive saturation region. The noise meter was based on a zero-modulation radiometer circuit with consideration of the low noise level of electron field emission. The results of the study show an effect of suppression of non-fractional components of excess noise on the light-sensitive segment of the current-voltage curve. This effect gives silicon autocathodes considerable advantages for use as sensitive photodetectors. Figures 2; references 7: 6 Russian, 1 Western.
[123-6610]

USSR UDC 535.2

SUPERRADIANCE IN THE RADIO BAND, CREATED BY OPTICAL PULSES UNDER CONDITIONS OF THE PHOTON ECHO EFFECT

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 10, 1979 pp 1213-1217
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[Abstract] A study is made of the origin of radio frequency coherence between components of a hyperfine structure under conditions of the photon echo effect. Superradiance pulses of the photon echo type are formed under conditions of multiple resonance and are distinguished by the fact that they can arise both at the excitation frequency and at combination frequencies. In three-level atoms an important feature of the photon echo effect is the modulation dependence of the intensity of coherent spontaneous radiation with double radio-optical resonance. The possibility of the origin of a radio frequency response in a strong high-frequency field was demonstrated in an earlier study (1957). A study is made here of the origin of superradiance in the radio band in atomic systems in which the diagonal components of the dipole moment equal zero. It is assumed that a system of three-level atoms with a non-equidistant spectrum is excited by a sequence of two coherent optical pulses. The frequency of external pulses enters into resonance with a transition from level 2 to level 3, whereas the radiation discussed has the frequency of the transition from level 1 to level 2. This effect is possible only in a strong field of excitation pulses on the condition that $d_{23}E/\hbar > \Omega_{12}$, where d_{23} is the module of the matrix element of the dipole transition, Ω_{12} is the frequency of the transition between levels 1 and 2, and E is the amplitude of the external field. Under this condition additional broadening of the spectrum of external pulses overlaps frequency interval Ω_{12} and the coherent superposition of all three states becomes possible. The origin of non-diagonal density matrix elements differing from zero for states 1 and 2 results in a macroscopic multipole moment and in radiation at a frequency corresponding to the radio frequency transition. The behavior of a three-level atom in a field of light pulses is described by the Schroedinger equation for a three-row density matrix with a Hamiltonian taking into account the dipole nature of the interaction betwen the external field and atom. The number of coherent radio frequency responses of the medium is found to equal five, and expressions are arrived at for the amplitudes of responses. The conditions for three-dimensional synchronism in the microwave band are discussed. The effect discussed can be observed experimentally in a hyperfine structure in atomic gases of the Cs type and in rotational-vibrational transitions in molecular gases. The origin of radio frequency responses is possible also in electron-donor spin levels in semiconductor crystals of n-type CdS, as well as in the system of levels originating in paramagnetic

crystals when degeneration is removed by an external magnetic field. The phenomenon discussed can be employed in superhigh-resolution spectroscopy. Figures 1; tables 1; references 12: 6 Russian, 6 Western.
[03-8831]

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